□ Tentative Specification
□ Preliminary Specification
■ Approval Specification

MODEL NO.: V650HP1

SUFFIX: LS6

Customer:

APPROVED BY SIGNATURE

Name / Title _____ _____

Note

Please return 1 copy for your confirmation with your signature and comments.

Approved By	Checked By	Prepared By
Chao-Chun Chung	Perry Lin	Chloe Chen

CONTENTS

REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver. 2.0	10/17, 2012	ALL	ALL	The approval specification was been released.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

V650HP1-LS6 is a 64.5" TFT Liquid Crystal Display module with LED Backlight unit and 4ch LVDS interface. This module supports 1920 x 1080 Full HDTV format and can display 1.07G colors (8 bit+FRC). The converter module for backlight is built-in.

1.2 FEATURES

- High brightness (400 nits)
- High contrast ratio (5000:1)
- Fast response time (Gray to Gray typical : 6.5 ms)
- High color saturation (NTSC 70%)
- Full HDTV (1920 x 1080 pixels) resolution, true HDTV format
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Optimized response time for 120 Hz frame rate
- Viewing Angle : 176(H)/176(V) (CR>20) Technology
- Ultra wide viewing angle: Super MVA technology
- RoHs compliance
- T-con input frame rate: 100Hz/120Hz, output frame rate: 100Hz/120Hz

1.3 APPLICATION

- Standard Living Room TVs
- Public Display Application
- Home Theater Application
- MFM Application

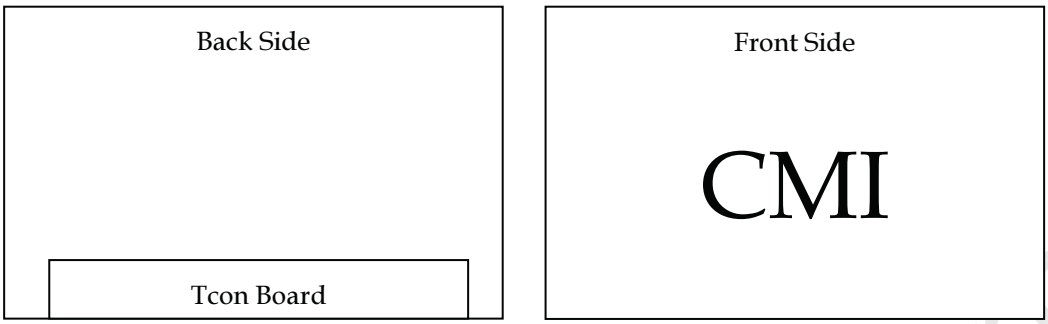
1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Active Area	1428.5 (H) x 803.5 (V) (64.5" diagonal)	mm	(1)
Bezel Opening Area	1435.5(H) x 810.5(V)	mm	
Driver Element	a-si TFT active matrix	—	—
Pixel Number	1920 x R.G.B. x 1080	pixel	—
Pixel Pitch(Sub Pixel)	0.248 (H) x 0.744 (V)	mm	—
Pixel Arrangement	RGB vertical stripe	—	—
Display Colors	1.07G colors (10 bits)	color	—
Display Operation Mode	Transmissive mode / Normally black	—	—
Surface Treatment	Anti-Glare coating (Haze 1%)	—	(2)
Rotation Function	Unachievable	—	(3)
Display Orientation	Signal input with "CMI"	—	(3)

Note (1) Please refer to the attached drawings in chapter 11 for more information about the front and back outlines.

Note (2) The spec of the surface treatment is temporarily for this phase. CMI reserves the rights to change this feature.

Note (3)



1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	1448.7	1450.5	1452.3	mm	(1),(2)
	Vertical (V)	827.0	828.5	830.0	mm	(1),(2)
	Depth (D)	28.8	29.8	30.8	mm	To converter cover
		16.8	17.8	18.8	mm	To Rear
Weight		—	25000	—	—	—

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2) Module depth does not include connectors.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	50	ºC	(1), (2)
Shock (Non-Operating)	S_{NOP}	—	35	G	(3), (5)
Vibration (Non-Operating)	V_{NOP}	—	1.0	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta ≦ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

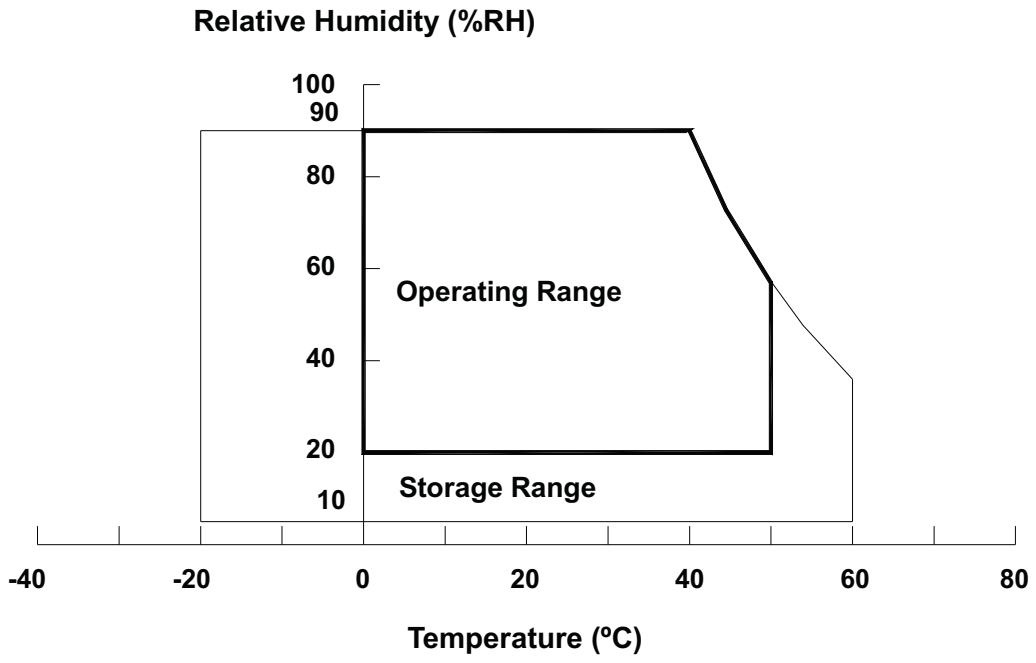
(c) No condensation.

Note (2) Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 ºC. The range of operating temperature may degrade in case of improper thermal management in final product design.

Note (3) 11 ms, half sine wave, 1 time for ± X, ± Y, ± Z.

Note (4) 10 ~ 200 Hz, 30 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.



2.2 PACKAGE STORAGE

When storing modules as spares for a long time, the following precaution is necessary.

(a) Do not leave the module in high temperature and high humidity for a long time, It is highly recommended to store the module with temperature from 0 to 35 ℃ at normal humidity without condensation.

(b) The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.

2.3 ELECTRICAL ABSOLUTE RATINGS

2.3.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V_{CC}	-0.3	13.5	V	(1)
Logic Input Voltage	V_{IN}	-0.3	3.6	V	

2.3.2 BACKLIGHT CONVERTER UNIT

Item	Symbol	Test Condition	Min.	Type	Max.	Unit	Note
Light Bar Voltage	V_W	Ta = 25 ℃	—	—	80.5	V_{RMS}	3D Mode
Converter Input Voltage	V_{BL}	—	0	—	30	V	—
Control Signal Level	—	—	-0.3	—	6	V	—

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under normal operating conditions.

Note (2) No moisture condensation or freezing.

Note (3) The control signals include On/Off control and external PWM control.

3. ELECTRICAL CHARACTERISTICS

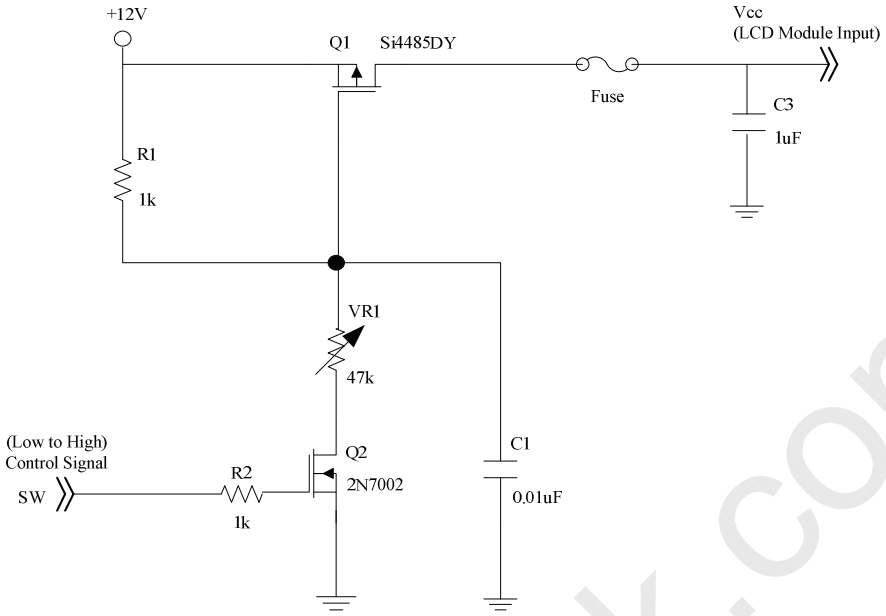
3.1 TFT LCD MODULE

(Ta = 25 ± 2 ºC)

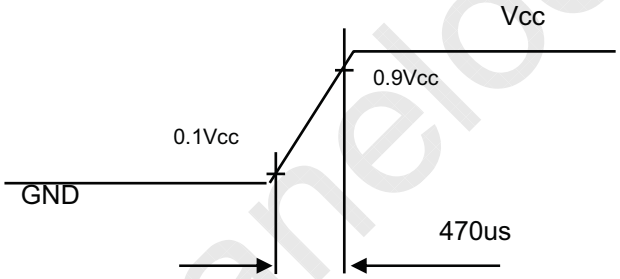
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{CC}	10.8	12	13.2	V	(1)
Rush Current		I_{RUSH}	–	–	3.2	A	(2)
Power Consumption	White Pattern	P_T	–	7.68	9.24	W	(3)
	Black Pattern	P_T	–	7.56	9.12	W	
	Horizontal Stripe	P_T	–	14.88	18	W	
Power Supply Current	White Pattern	–	–	0.64	0.77	A	
	Black Pattern	–	–	0.63	0.76	A	
	Horizontal Stripe	–	–	1.24	1.5	A	
LVDS interface	Differential Input High Threshold Voltage	V_{LVTH}	+100	–	+300	mV	(4)
	Differential Input Low Threshold Voltage	V_{LVTL}	-300	–	-100	mV	
	Common Input Voltage	V_{CM}	1.0	1.2	1.4	V	
	Differential input voltage (single-end)	$\|V_{ID}\|$	200	–	600	mV	
	Terminating Resistor	R_T	–	100	–	ohm	
CMOS interface	Input High Threshold Voltage	V_{IH}	2.7	–	3.3	V	–
	Input Low Threshold Voltage	V_{IL}	0	–	0.7	V	–

Note (1) The module should be always operated within the above ranges. The ripple voltage should be controlled under 10% of Vcc (Typ.)

Note (2) Measurement condition :



Vcc rising time is 470us



Note (3) The specified power supply current is under the conditions at Vcc = 12 V, Ta = 25 ± 2 °C, fv = 120Hz, whereas a power dissipation check pattern below is displayed.

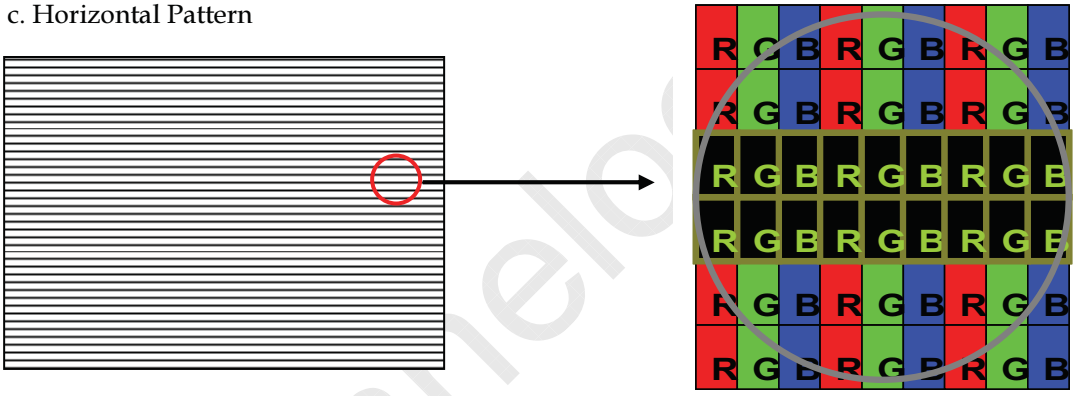
a. White Pattern

Active Area

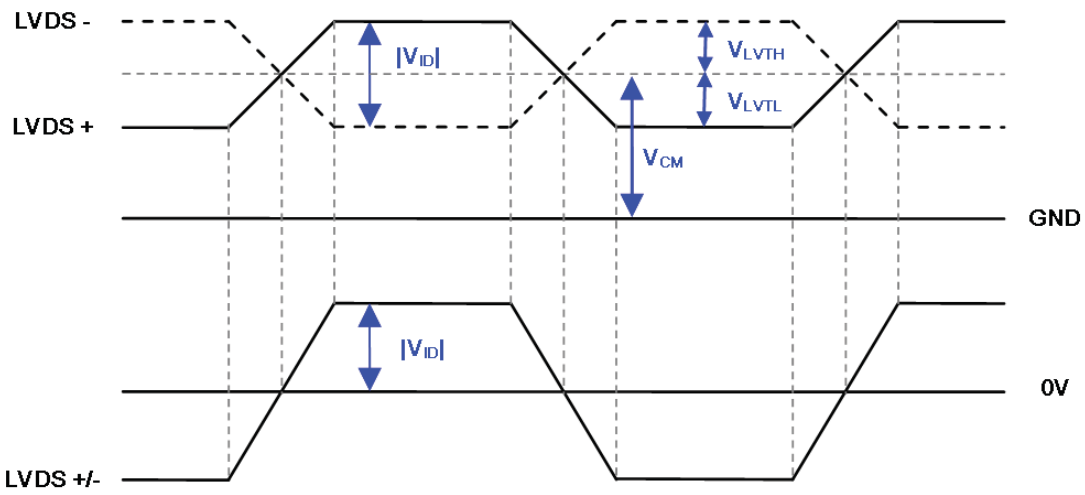
b. Black Pattern

Active Area

c. Horizontal Pattern



Note (4) The LVDS input characteristics is shown as below :



3.2 BACKLIGHT UNIT

3.2.1 LED LIGHT BARCHARACTERISTICS

The backlight unit contains 4 pcs LED light bars and each light bar has 4 string LED

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
One String Current	$I_{L(2D)}$	117.5	125	132.5	mA	(1)
	$I_{L(3D)}$	423	450	477	mApeak	3D ENA=ON
One String Voltage	V_W	50.85	—	58.43	V_{DC}	I_L =125mA
One String Voltage Variation	$\triangle V_W$	—	—	2	V	—
Life time	—	30,000	—	—	Hrs	(2)

Note (1) Dimming Ratio=100%

Note (2) The lifetime is defined as the time which luminance of the LED decays to 50% compared to the initial value.Operating condition: Continuous operating at Ta = 25±2℃, I_L = 125mA.

3.2.2 CONVERTER CHARACTERISTICS

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Consumption	$P_{BL(2D)}$	—	124.6	148.5	W	(1), (2), IL=125 mA
	$P_{BL(3D)}$	—	109.15	133.41	W	(1), (2), IL=450 mA
Converter Input Voltage	VBL	22.8	24.0	25.2	VDC	—
Converter Input Current	$I_{BL(2D)}$	—	5.19	6.19	A	Non Dimming
	$I_{BL(3D)}$	—	4.55	5.56	A	—
Input Inrush Current	$I_{R(2D)}$	—	—	11	Apeak	V_{BL}=22.8V, (IL=typ.) (3), (6)
	$I_{R(3D)}$	—	—	18	Apeak	V_{BL}=22.8V,(IL= 360 mA.) (3), (6)
Dimming Frequency	FB	170	180	190	Hz	(5)
Dimming Duty Ratio	DDR	5	—	100	%	(4), (5)

Note (1) The power supply capacity should be higher than the total converter power consumption P_{BL}. Since the pulse width modulation (PWM) mode was applied for backlight dimming, the driving current changed as PWM duty on and off. The transient response of power supply should be considered for the changing loading when converter dimming.

Note (2) The measurement condition of Max. value is based on 65" backlight unit under input voltage 24V, average LED current 132.5mA at 2D Mode (LED current 477mA_{peak} at 3D Mode) and lighting 1 hour later.

Note (3) For input inrush current measure, the VBL rising time from 10% to 90% is about 30ms.

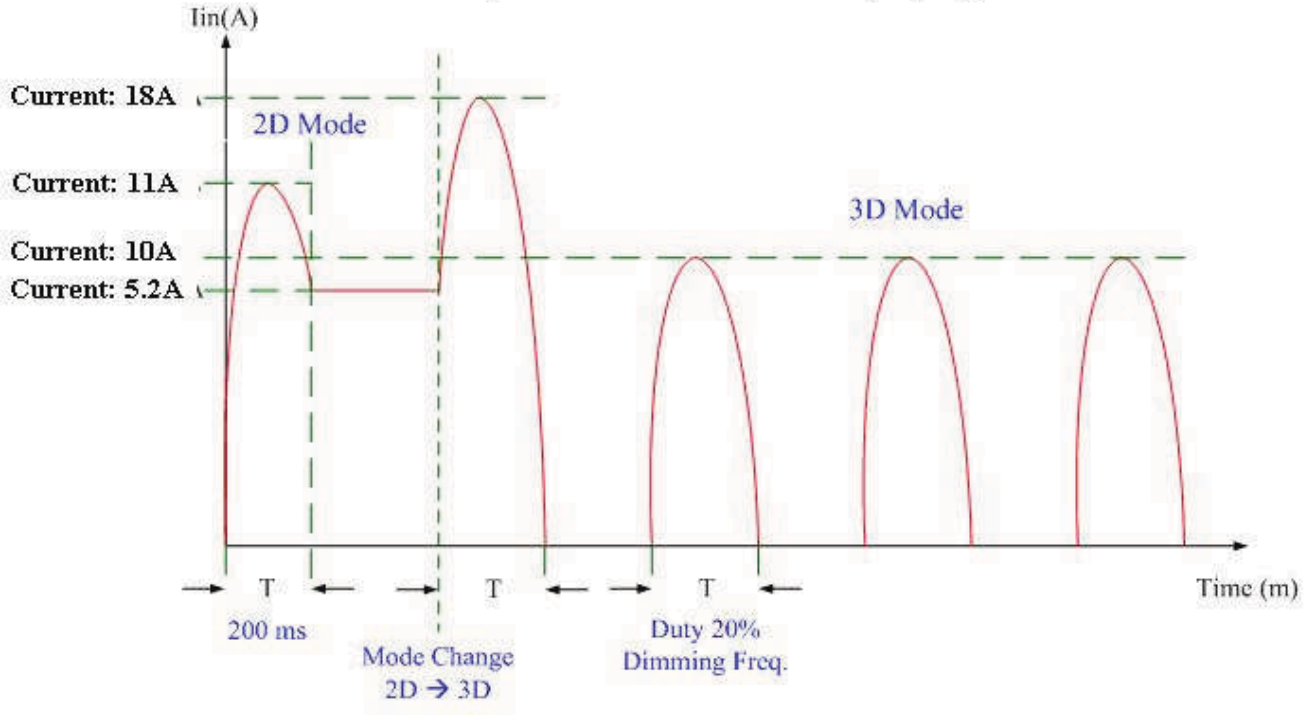
Note (4) EPWM signal have to input available duty range. Between 97% and 100% duty (DDR) have to be avoided.

(97% < DDR < 100%) But 100% duty(DDR) is possible. 5% duty (DDR) is only valid for electrical operation.

Note (5) FB and DDR are available only at 2D Mode.

Note (6) Below diagram is only for power supply design reference.

Test Condition: VBL=22.8V, IL=125mA at 2D Mode/ IL=(450)mApeak at 3D Mode.



3.2.3 CONVERTER INTERFACE CHARACTERISTICS

Parameter		Symbol	Test Condition	Value			Unit	Note	
				Min.	Typ.	Max.			
On/Off Control Voltage	ON	VBLON	—	2.0	—	5.0	V	—	
	OFF		—	0	—	0.8	V		
External PWM Control Voltage	HI	VEPWM	—	2.0	—	5.25	V	Duty on	(5), (6)
	LO		—	0	—	0.8	V	Duty off	
External PWM Frequency		F_{EPWM}	—	150	160	170	Hz	Normal mode (7)	
Error Signal		ERR	—	—	—	—	—	Abnormal: Open	
VBL Rising Time		Tr1	—	20	—	—	ms	10%-90%V_{BL}	
Control Signal Rising Time		Tr	—	—	—	100	ms	—	
Control Signal Falling Time		Tf	—	—	—	100	ms	—	
PWM Signal Rising Time		TPWMR	—	—	—	50	us	(6)	
PWM Signal Falling Time		TPWMF	—	—	—	50	us		
Input Impedance		Rin	—	1	—	—	MΩ	EPWM, BLON	
PWM Delay Time		TPWM	—	100	—	—	ms	(6)	
BLON Delay Time		T_{on}	—	300	—	—	ms	—	
		T_{on1}	—	300	—	—	ms	—	
BLON Off Time		Toff	—	300	—	—	ms	—	

Note (1) The Dimming signal should be valid before backlight turns on by BLON signal. It is inhibited to change the external PWM signal during backlight turn on period.

Note (2) The power sequence and control signal timing are shown in the Fig.1. For a certain reason, the converter has a possibility to be damaged with wrong power sequence and control signal timing.

Note (3) While system is turned ON or OFF, the power sequences must follow as below descriptions:

Turn ON sequence: VBL → PWM signal → BLON

Turn OFF sequence: BLOFF → PWM signal → VBL

Note (4) When converter protective function is triggered, ERR will output open collector status. Please refers to Fig.2.

Note (5) The EPWM interface that inserts a pull up resistor to 5V in Max Duty (100%), please refers to Fig.3.

Note (6) EPWM is available only at 2D Mode.

Note (7) EPWM signal have to input available frequency range.

Note (8) [Recommend] EPWM duty ratio is set at 100%(Max. Brightness) in 3D Mode.

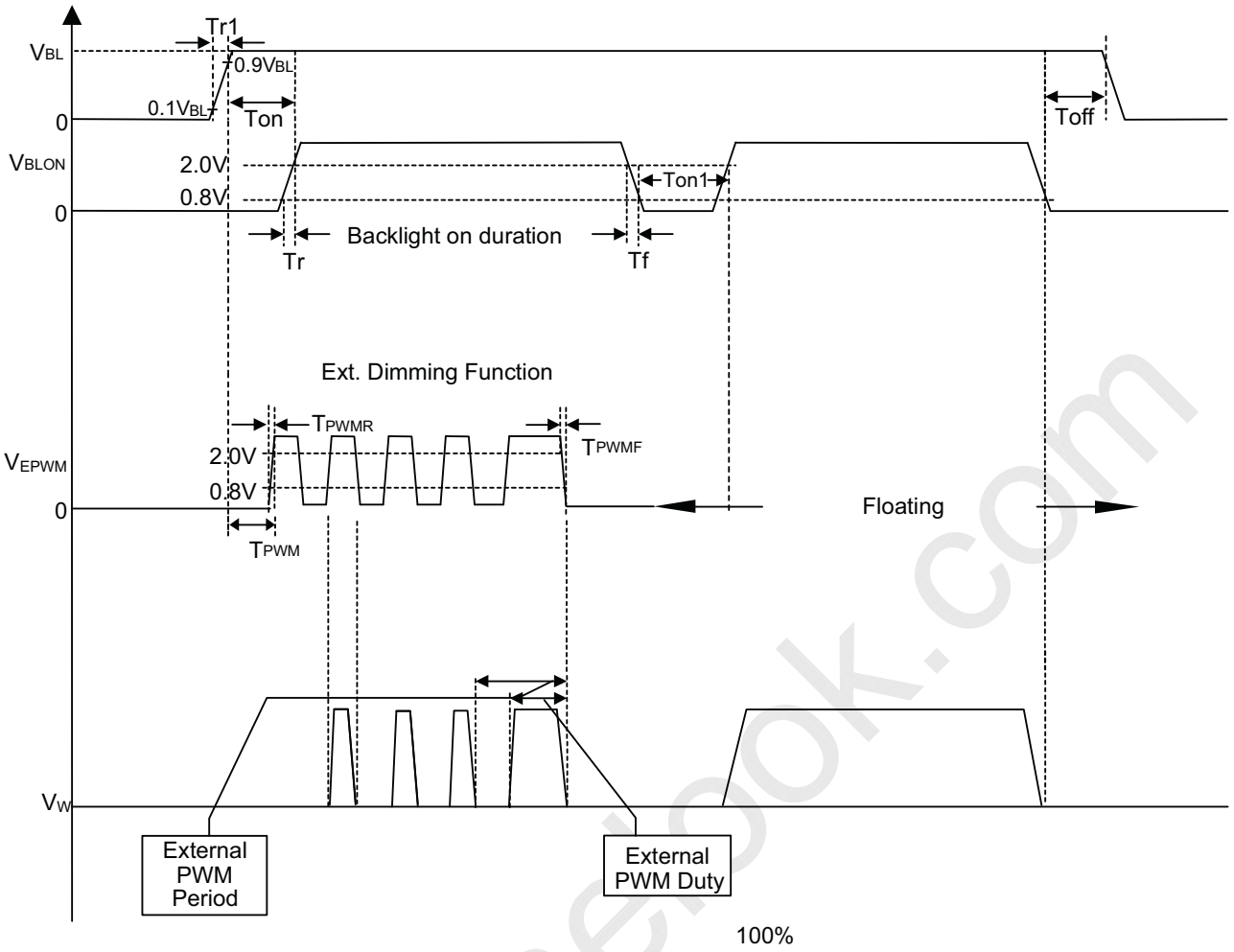


Fig. 1

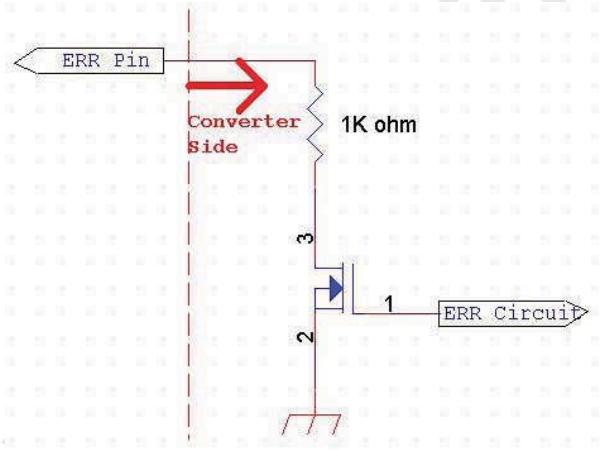


Fig. 2

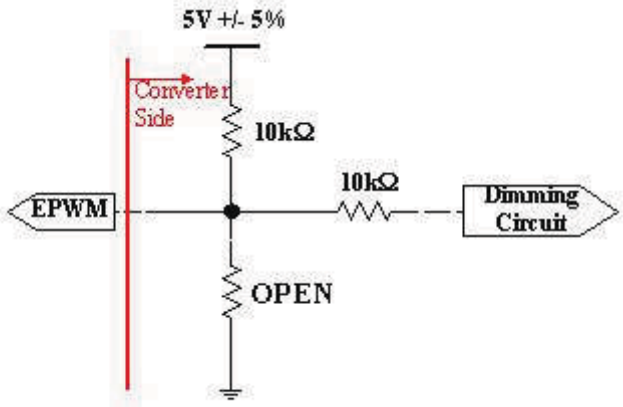
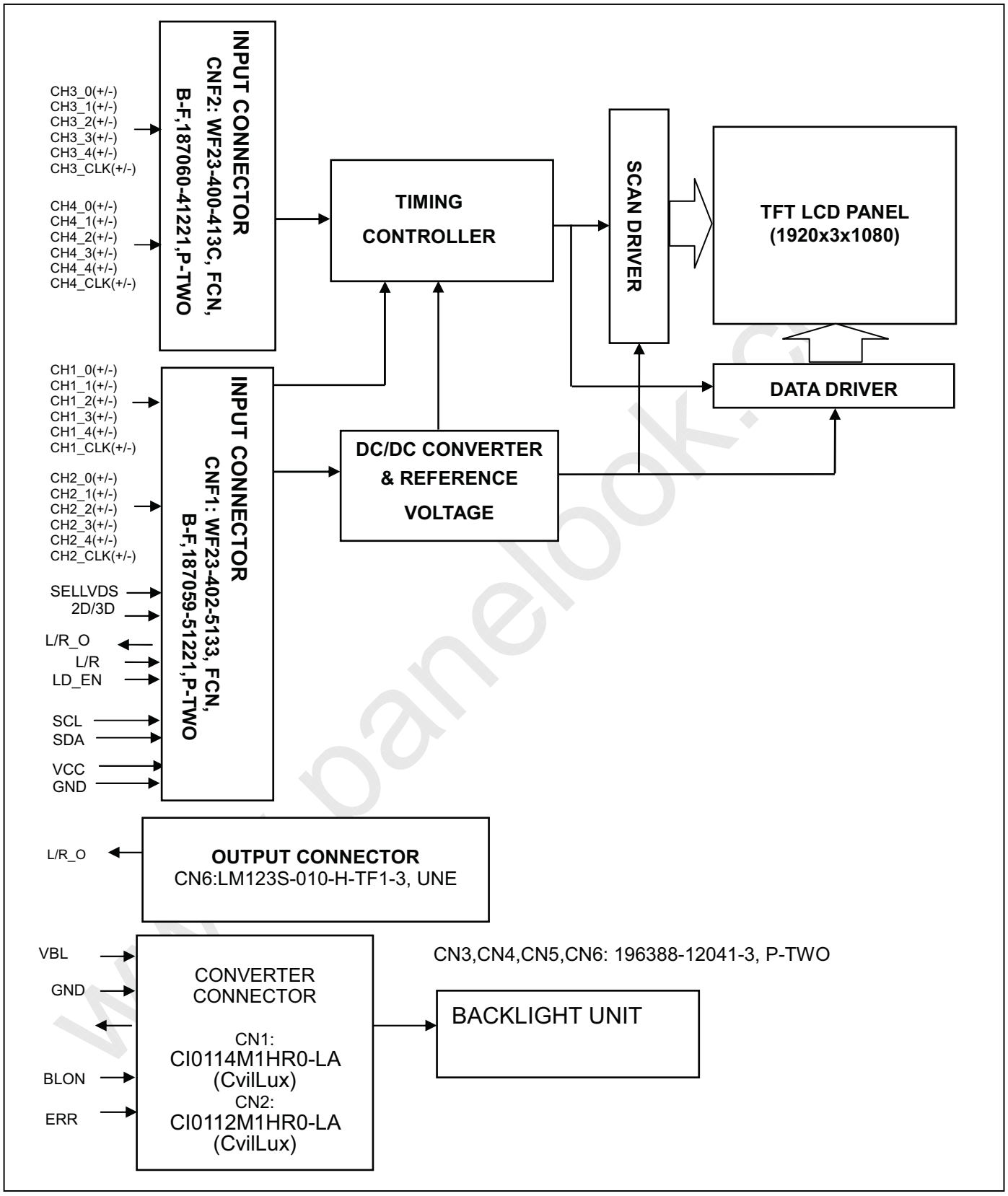


Fig. 3

4. BLOCK DIAGRAM OF INTERFACE

4.1 TFT LCD MODULE



5 .INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

CNF1 Connector Pin Assignment (WF23-402-5133 (FCN) , B-F,187059-51221(P-TWO))

Pin	Name	Description	Note
1	N.C.	No Connection	(1)
2	SCL	I2C Serial Clock (for local dimming demo function)	(10)
3	SDA	I2C Serial Data (for local dimming demo function)	
4	N.C.	No Connection	(1)
5	L/R_O	Output signal for Left Right Glasses control	(9)
6	N.C.	No Connection	(1)
7	SELLVDS	Input signal for LVDS Data Format Selection	(2)(6)
8	N.C.	No Connection	(1)
9	N.C.	No Connection	
10	N.C.	No Connection	
11	GND	Ground	–
12	CH1[0]-	First pixel Negative LVDS differential data input. Pair 0	(8)
13	CH1[0]+	First pixel Positive LVDS differential data input. Pair 0	
14	CH1[1]-	First pixel Negative LVDS differential data input. Pair 1	
15	CH1[1]+	First pixel Positive LVDS differential data input. Pair 1	
16	CH1[2]-	First pixel Negative LVDS differential data input. Pair 2	
17	CH1[2]+	First pixel Positive LVDS differential data input. Pair 2	
18	GND	Ground	–
19	CH1CLK-	First pixel Negative LVDS differential clock input.	(8)
20	CH1CLK+	First pixel Positive LVDS differential clock input.	
21	GND	Ground	–
22	CH1[3]-	First pixel Negative LVDS differential data input. Pair 3	(8)
23	CH1[3]+	First pixel Positive LVDS differential data input. Pair 3	
24	CH1[4]-	First pixel Negative LVDS differential data input. Pair 4	
25	CH1[4]+	First pixel Positive LVDS differential data input. Pair 4	
26	2D/3D	Input signal for 2D/3D Mode Selection	(3)(7)
27	L/R	Input signal for Left Right eye frame synchronous	(4)(7)
28	CH2[0]-	Second pixel Negative LVDS differential data input. Pair 0	(8)

29	CH2[0]+	Second pixel Positive LVDS differential data input. Pair 0	
30	CH2[1]-	Second pixel Negative LVDS differential data input. Pair 1	
31	CH2[1]+	Second pixel Positive LVDS differential data input. Pair 1	
32	CH2[2]-	Second pixel Negative LVDS differential data input. Pair 2	
33	CH2[2]+	Second pixel Positive LVDS differential data input. Pair 2	
34	GND	Ground	–
35	CH2CLK-	Second pixel Negative LVDS differential clock input.	(8)
36	CH2CLK+	Second pixel Positive LVDS differential clock input.	
37	GND	Ground	–
38	CH2[3]-	Second pixel Negative LVDS differential data input. Pair 3	(8)
39	CH2[3]+	Second pixel Positive LVDS differential data input. Pair 3	
40	CH2[4]-	Second pixel Negative LVDS differential data input. Pair 4	
41	CH2[4]+	Second pixel Positive LVDS differential data input. Pair 4	
42	LD_EN	Input signal for Local Dimming Enable	(5)(6)
43	N.C.	No Connection	(1)
44	GND	Ground	–
45	GND	Ground	–
46	GND	Ground	–
47	N.C.	No Connection	(1)
48	VCC	+12V power supply	–
49	VCC	+12V power supply	–
50	VCC	+12V power supply	–
51	VCC	+12V power supply	–

CNF2 Connector pin assignment (WF23-400-413C (FCN) , B-F,187060-41221(P-TWO))

Pin	Name	Description	Note
1	N.C.	No Connection	(1)
2	N.C.	No Connection	
3	N.C.	No Connection	
4	N.C.	No Connection	
5	N.C.	No Connection	
6	N.C.	No Connection	

7	N.C.	No Connection	
8	N.C.	No Connection	
9	GND	Ground	–
10	CH3[0]-	Third pixel Negative LVDS differential data input. Pair 0	(8)
11	CH3[0]+	Third pixel Positive LVDS differential data input. Pair 0	
12	CH3[1]-	Third pixel Negative LVDS differential data input. Pair 1	
13	CH3[1]+	Third pixel Positive LVDS differential data input. Pair 1	
14	CH3[2]-	Third pixel Negative LVDS differential data input. Pair 2	
15	CH3[2]+	Third pixel Positive LVDS differential data input. Pair 2	
16	GND	Ground	–
17	CH3CLK-	Third pixel Negative LVDS differential clock input.	(8)
18	CH3CLK+	Third pixel Positive LVDS differential clock input.	
19	GND	Ground	–
20	CH3[3]-	Third pixel Negative LVDS differential data input. Pair 3	(8)
21	CH3[3]+	Third pixel Positive LVDS differential data input. Pair 3	
22	CH3[4]-	Third pixel Negative LVDS differential data input. Pair 4	
23	CH3[4]+	Third pixel Positive LVDS differential data input. Pair 4	
24	GND	Ground	–
25	GND	Ground	–
26	CH4[0]-	Fourth pixel Negative LVDS differential data input. Pair 0	(8)
27	CH4[0]+	Fourth pixel Positive LVDS differential data input. Pair 0	
28	CH4[1]-	Fourth pixel Negative LVDS differential data input. Pair 1	
29	CH4[1]+	Fourth pixel Positive LVDS differential data input. Pair 1	
30	CH4[2]-	Fourth pixel Negative LVDS differential data input. Pair 2	
31	CH4[2]+	Fourth pixel Positive LVDS differential data input. Pair 2	
32	GND	Ground	–
33	CH4CLK-	Fourth pixel Negative LVDS differential clock input.	(8)
34	CH4CLK+	Fourth pixel Positive LVDS differential clock input.	
35	GND	Ground	–
36	CH4[3]-	Fourth pixel Negative LVDS differential data input. Pair 3	(8)
37	CH4[3]+	Fourth pixel Positive LVDS differential data input. Pair 3	
38	CH4[4]-	Fourth pixel Negative LVDS differential data input. Pair 4	

39	CH4[4]+	Fourth pixel Positive LVDS differential data input. Pair 4	
40	GND	Ground	–
41	GND	Ground	–

CN6 Connector pin assignment (LM123S-010-H-TF1-3 (UNE))

1	N.C.	No Connection	(1)
2	N.C.	No Connection	
3	N.C.	No Connection	
4	GND	Ground	–
5	N.C.	No Connection	(1)
6	L/R_O	Output signal for Left Right Glasses control	(9)
7	N.C.	No Connection	(1)
8	N.C.	No Connection	
9	N.C.	No Connection	
10	N.C.	No Connection	

Note (1) Reserved for internal use. Please leave it open.

Note (2) LVDS format selection.

L= Connect to GND, H=Connect to +3.3V or Open

SELLVDS	Note
L	JEIDA Format
H or Open	VESA Format

Note (3) 2D/3D mode selection. (2D/3D mode is only controlled by this pin)

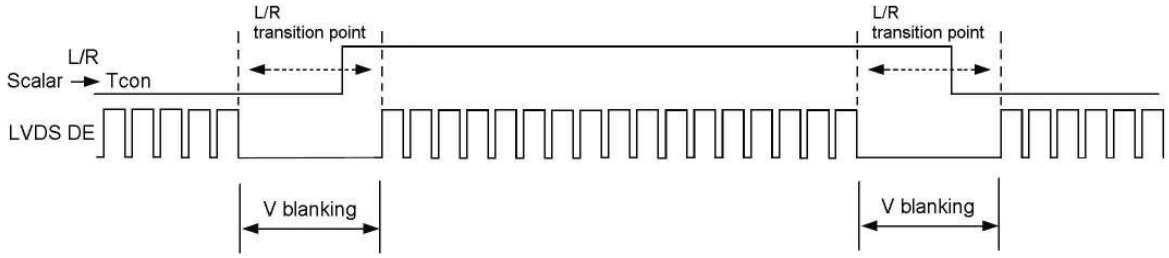
L= Connect to GND or Open, H=Connect to +3.3V

2D/3D	Note
L or Open	2D Mode
H	3D Mode

Note (4) Input signal for left and right eye frame synchronous

L=0V~0.7 V, H=2.7V~3.3 V

L/R	Note
L	Right synchronous signal
H	Left synchronous signal



Note (5) Local dimming enable selection.

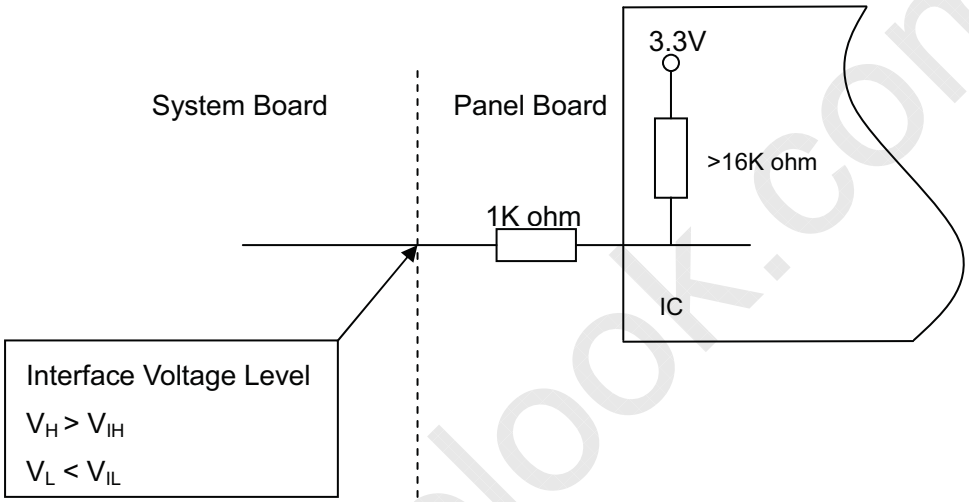
L= Connect to GND，H=Connect to +3.3V or Open

LD_EN	Note
L	Local Dimming Disable
H or Open	Local Dimming Enable

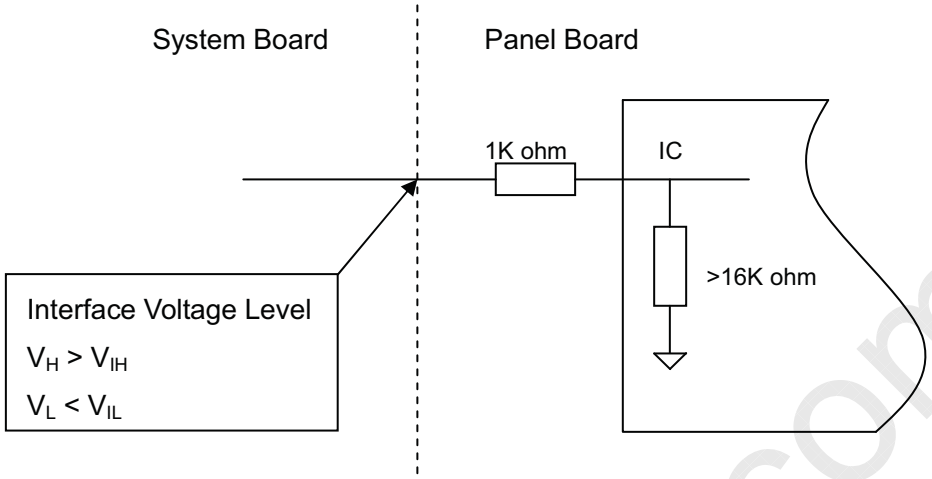
LD_EN enable pin should be set in power on stage.

Backlight should be turned off in the period of changing original setting after power on.

Note (6) Interface optional pin has internal scheme as following diagram. Customer should keep the interface voltage level requirement which including panel board loading as below.



Note (7) Interface optional pin has internal scheme as following diagram. Customer should keep the interface voltage level requirement which including panel board loading as below.



Note (8) LVDS 4-port data mapping

Port	Channel of LVDS	Data Stream
1st Port	First Pixel	1, 5, 9, ……1913, 1917
2nd Port	Second Pixel	2, 6, 10, ….1914, 1918
3rd Port	Third Pixel	3, 7, 11, ….1915, 1919
4th Port	Fourth Pixel	4, 8, 12, ….1916, 1920

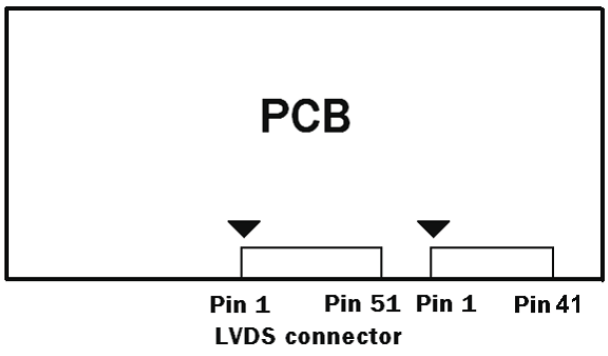
Note (9) The definition of L/R_O signal as follows

L= 0V , H= +3.3V

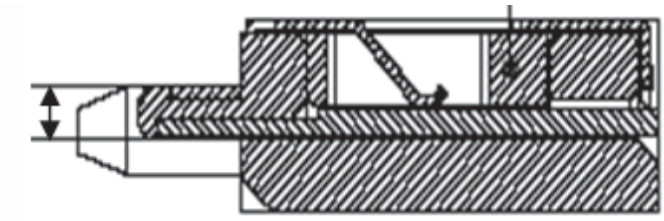
L/R_O	Note
L	Right glass turn on
H	Left glass turn on

Note (10) Please reference Appendix A

Note (11) LVDS connector pin order defined as follows



Note (12) LVDS connector mating dimension range request is 0.93mm~1.0mm as below



5.2 BACKLIGHT UNIT

The pin configuration for the housing and leader wire is shown in the table below.

CN3 & CN6 : P-TWO 196388-12041-3

Pin No	Symbol	Feature
1	NC	No Connection
2		
3	VLED-	Negative of LED String
4		
5		
6		
7	NC	No Connection
8		
9		
10	VLED+	Positive of LED String
11		
12		

CN4 & CN5 : P-TWO 196388-12041-3

Pin No	Symbol	Feature
1	VLED+	Positive of LED String
2		
3		
4	NC	No Connection
5		
6		
7	VLED-	Negative of LED String
8		
9		
10		
11	NC	No Connection
12		

5.3 CONVERTER UNIT

CN1 (Header) : CI0114M1HR0-LA (CvilLux)

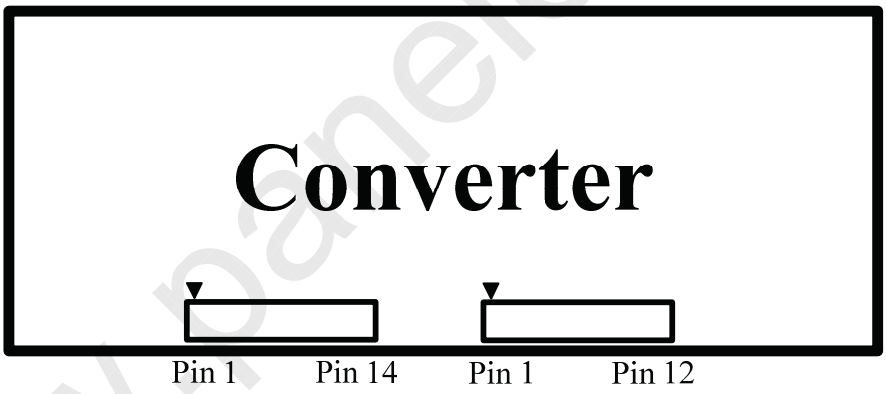
Pin №	Symbol	Feature
1	VBL	+24V
2		
3		
4		
5		
6	GND	GND
7		
8		
9		
10		
11	ERR	Normal : GND Abnormal : Open Collector
12	BLON	BL ON/OFF ON: Hi(2 ~ 5V) OFF: 0~0.8V/ GND
13	NC	NC
14	E_PWM	External PWM Control 5%~100% duty (Open for 100%)

Note (1) If Pin14 is open, E_PWM is 100% duty.

Note (2) Input connector pin order defined as follows

CN2: CI0112M1HR0-LA (CvilLux)

Pin №	Symbol	Feature
1	VBL	+24V
2		
3		
4		
5		
6	GND	GND
7		
8		
9		
10		
11	NC	NC
12	NC	NC

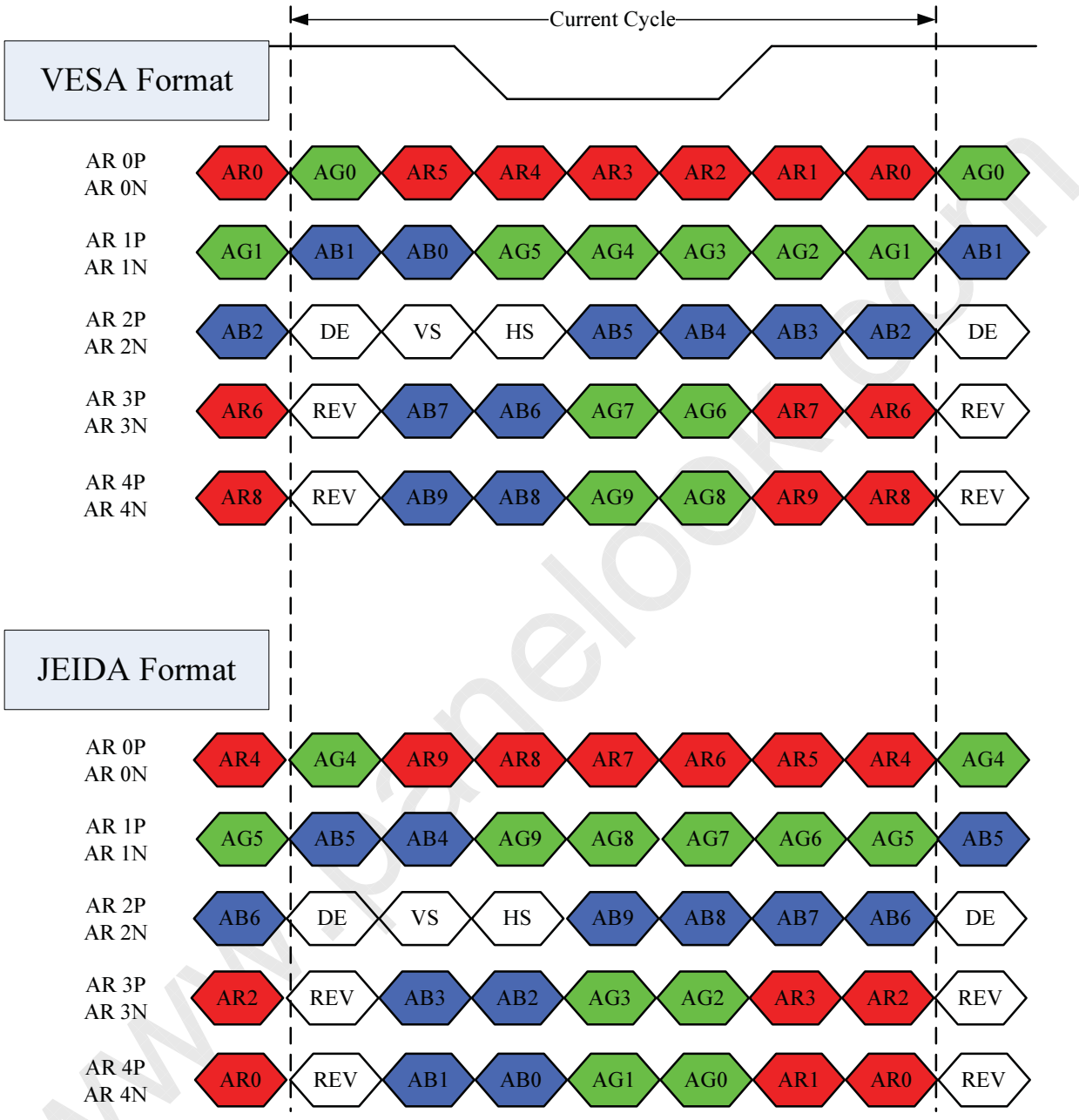


Input Connector

5.4 LVDS INTERFACE

JEIDA Format : SELLVDS = L

VESA Format : SELLVDS = H or Open



AR0~AR9	First Pixel R Data (9; MSB, 0; LSB)	DE	Data enable signal
AG0~AG9	First Pixel G Data (9; MSB, 0; LSB)	DCLK	Data clock signal
AB0~AB9	First Pixel B Data (9; MSB, 0; LSB)	RSVD	Reserved

5.5 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 10-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																													
		Red										Green										Blue									
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red (0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (1)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (2)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:			:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:			:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red (1021)	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (1022)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green (0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Green (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green (1021)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0
	Green (1022)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
	Green (1023)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue (0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue (1021)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1
	Blue (1022)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0
	Blue (1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage，1: High Level Voltage

6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram. (Ta = 25 ± 2 ºC)

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	F_{clkin} (=1/TC)	60	74.25	80	MHz	—
	Input cycle to cycle jitter	T_{rcl}	—	—	200	ps	(3)
	Spread spectrum modulation range	F_{clkin_mod}	F_{clkin}-2%	—	F_{clkin}+2%	MHz	(4)
	Spread spectrum modulation frequency	F_{SSM}	—	—	200	KHz	
LVDS Receiver Data	Receiver Skew Margin	T_{RSKM}	-400	—	400	ps	(5)

6.1.1 TIMING SPEC FOR FRAME RATE = 100HZ

Signal	Item		Symbol	Min.	Typ.	Max.	Unit	Note
Frame rate	2D mode		F_{r5}	94	100	106	Hz	(9),(10)
Vertical Active Display Term	2D Mode	Total	Tv	1090	1350	1395	Th	Tv=Tvd+Tvb
		Display	Tvd	1080	1080	1080	Th	—
		Blank	Tvb	10	270	315	Th	—
Horizontal Active Display Term	2D Mode	Total	Th	520	550	670	Tc	Th=Thd+Thb
		Display	Thd	480	480	480	Tc	—
		Blank	Thb	40	70	190	Tc	—

6.1.2 TIMING SPEC FOR FRAME RATE =120Hz

Signal	Item		Symbol	Min.	Typ.	Max.	Unit	Note
Frame rate	2D mode		F_{r6}	114	120	126	Hz	(9),(10)
	3D mode		F_{r6}	120	120	120	Hz	(7),(9),(10)
Vertical Active Display Term	2D Mode	Total	Tv	1090	1125	1395	Th	Tv=Tvd+Tvb
		Display	Tvd	1080	1080	1080	Th	—
		Blank	Tvb	10	45	315	Th	—
	3D Mdoe	Total	Tv	1125			Th	(6), (8)
		Display	Tvd	1080			Th	
		Blank	Tvb	45			Th	
Horizontal Active Display Term	2D Mode	Total	Th	520	550	670	Tc	Th=Thd+Thb
		Display	Thd	480	480	480	Tc	—
		Blank	Thb	40	70	190	Tc	—
	3D Mdoe	Total	Th	520	550	670	Tc	Th=Thd+Thb
		Display	Thd	480	480	480	Tc	—
		Blank	Thb	40	70	190	Tc	—

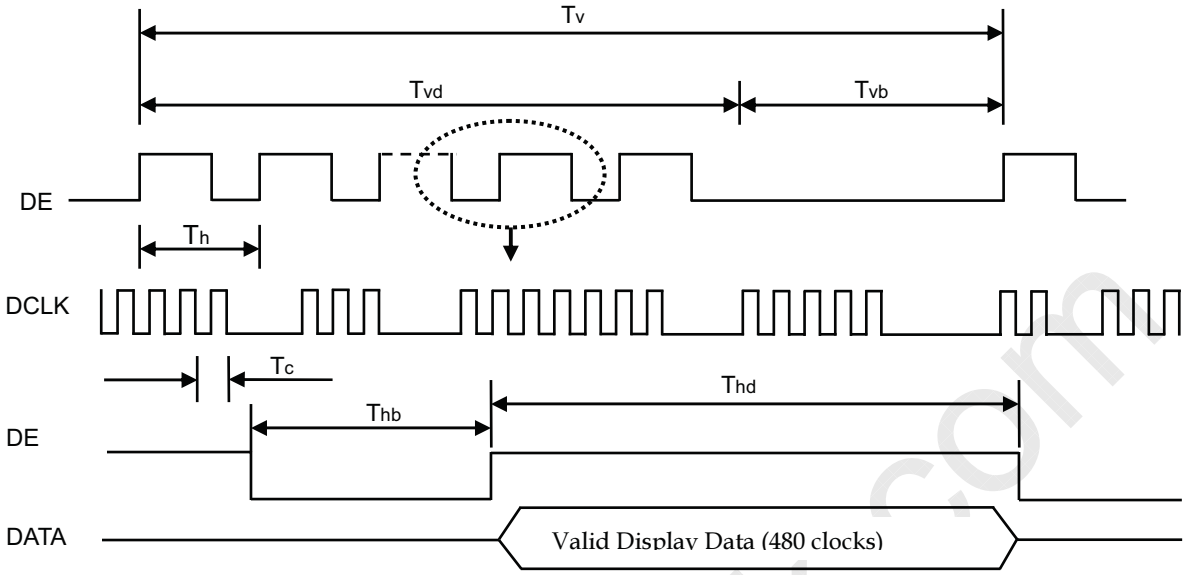
Note (1) Since the module is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this module would operate abnormally.

Note (2) Please make sure the range of pixel clock has follow the below equation:

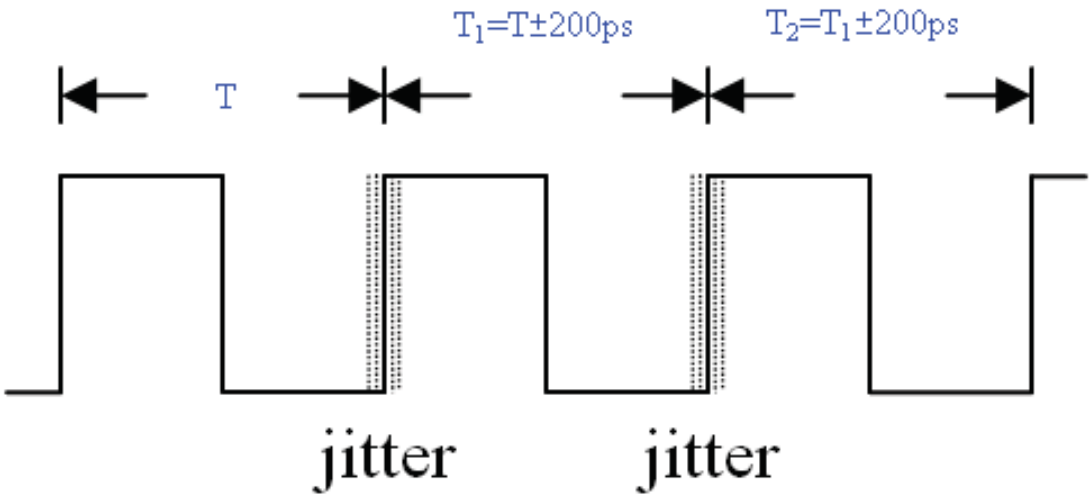
$Fclkin(max) \geqq Fr6 \times Tv \times Th$

$Fr5 \times Tv \times Th \geqq Fclkin(min)$

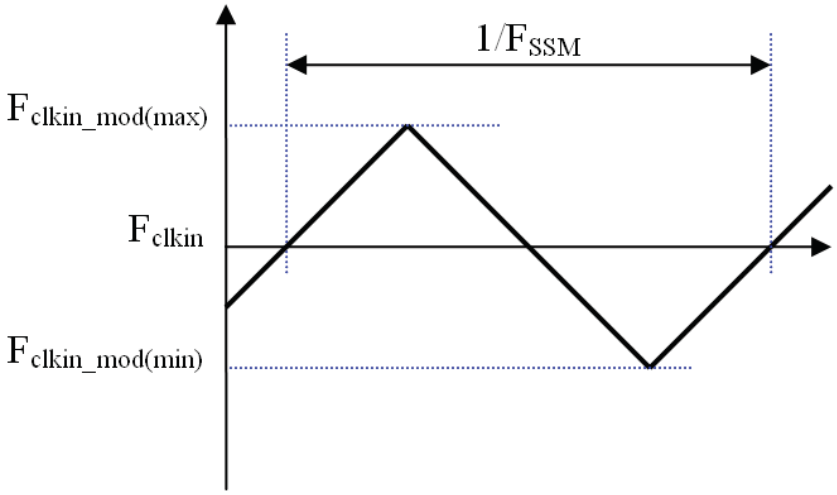
INPUT SIGNAL TIMING DIAGRAM



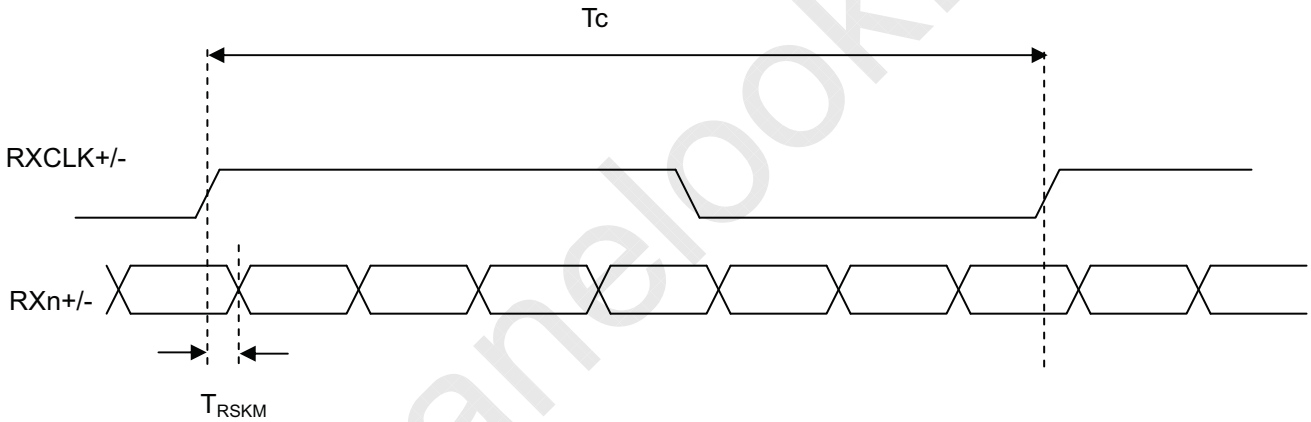
Note (3) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = | T_1 – T |



Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note (5) The LVDS timing diagram and the receiver skew margin is defined and shown in following figure.



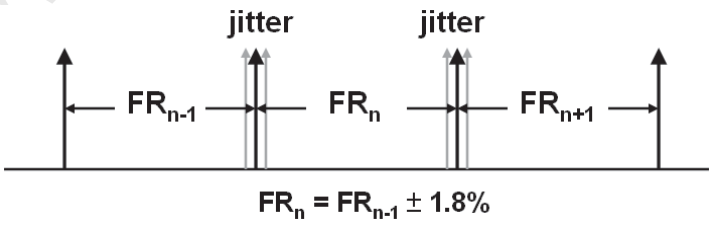
Note (6) Please fix the Vertical timing (Vertical Total =1125 / Display =1080 / Blank = 45) in 120Hz 3D mode

Note (7) In 3D mode, the set up Fr6 in Typ. ±3 Hz .In order to ensure that the electric function performance to avoid no display symptom.(Except picture quality symptom.)

Note (8) In 3D mode, the set up Tv and Tvb in Typ. ±30.In order to ensure that the electric function performance to avoid no display symptom.(Except picture quality symptom.)

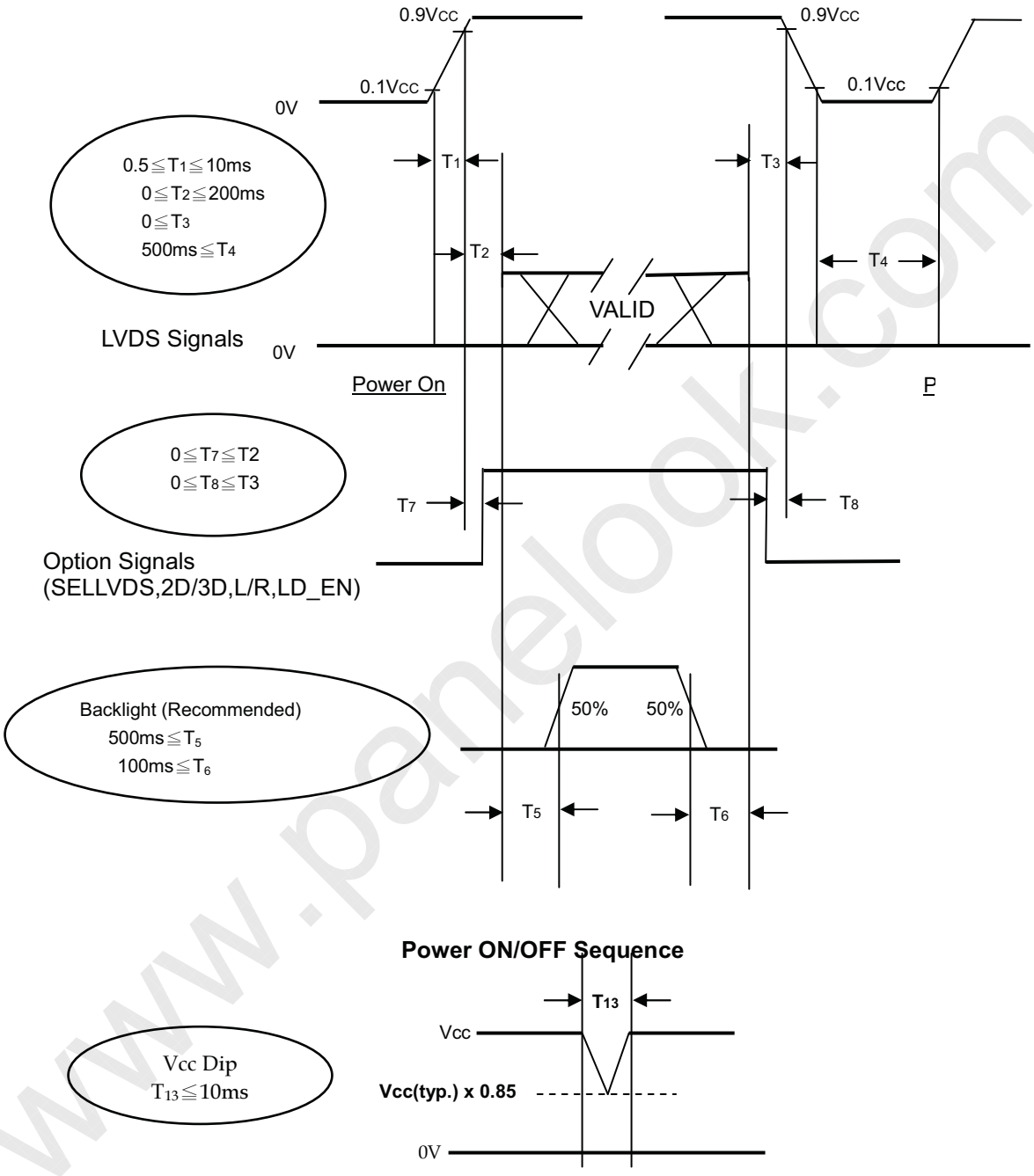
Note (9) The frame-to-frame jitter of the input frame rate is defined as the above figures. FRn = FRn-1 ± 1.8%.

Note (10) The setup of the frame rate jitter > 1.8% may result in the cosmetic LED backlight symptom but the electric function is not affected.



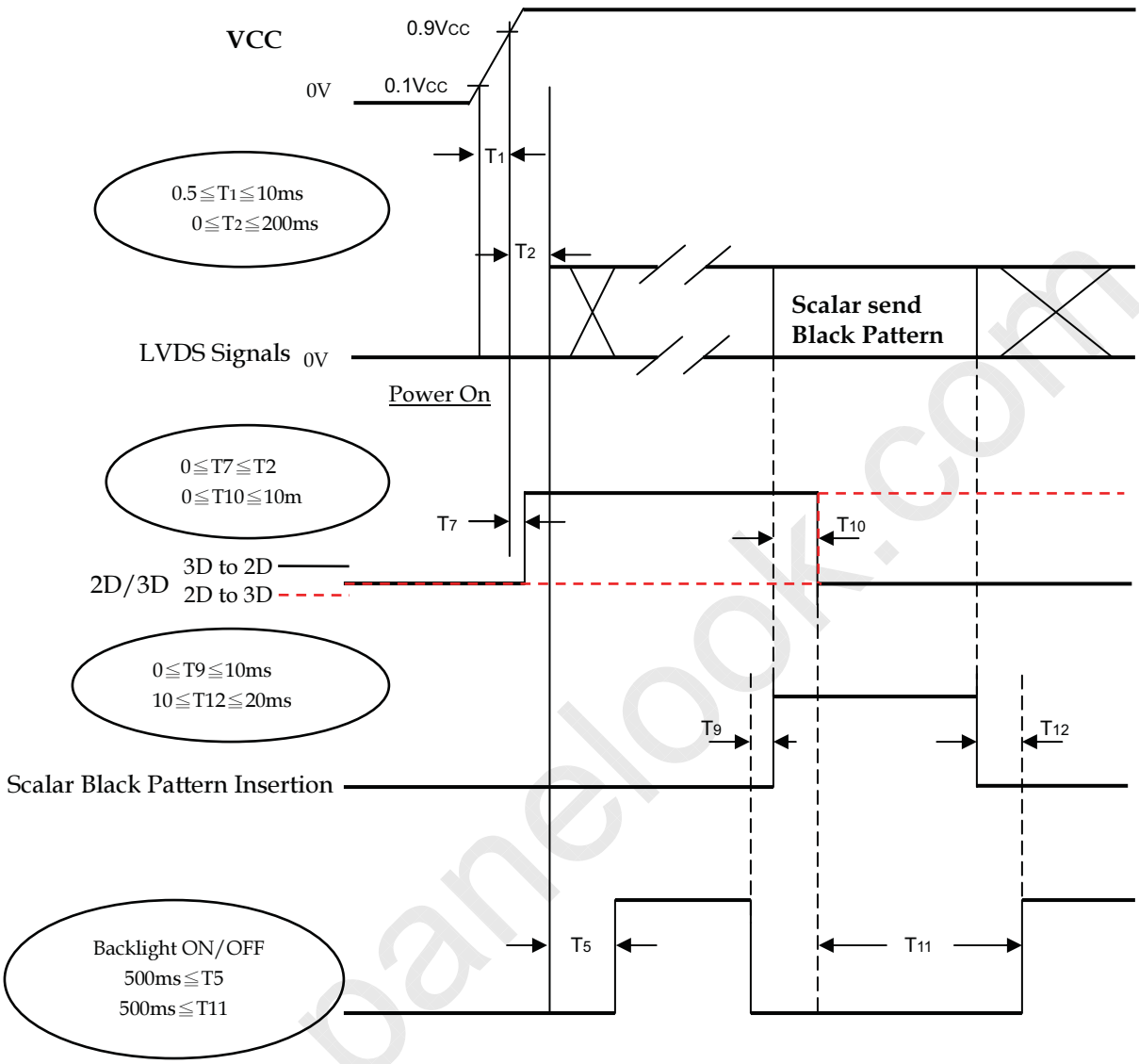
6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.



Power ON/OFF Sequence

6.3 2D/3D MODE CHANGE SIGNAL SEQUENCE WITHOUT VCC TURN OFF AND TURN ON



Note (1) The supply voltage of the external system for the module input should follow the definition of Vcc.

Note (2) Apply the LED voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of Vcc is in off level, please keep the level of input signals on the low or high impedance. If T2<0,that maybe cause electrical overstress failure.

Note (4) T4 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

Note (6) When 2D/3D mode is changed, TCON will insert black pattern internally. During black insertion, TCON would load required optical table and TCON parameter setting. The black insertion time should be longer than 650ms because TCON must recognize 2D or 3D format and set the correct parameter.

Note (7) Vcc must decay smoothly when power-off.

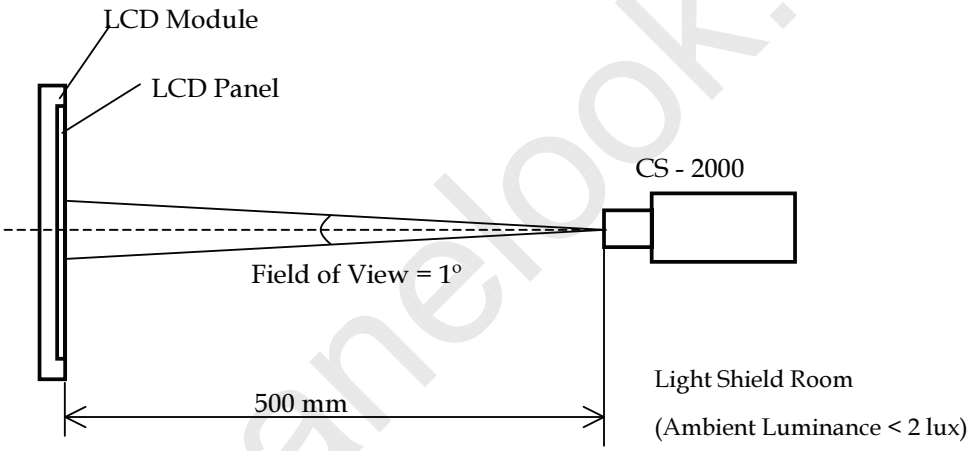
7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	12±1.2	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Current	I_L	125±3.75	mA
Vertical Frame Rate	Fr	120	Hz

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring in a windless room.

Local Dimming Function should be Disable before testing to get the steady optical characteristics (According to 5.1 CNF1 Connector Pin Assignment, Pin no. "42")



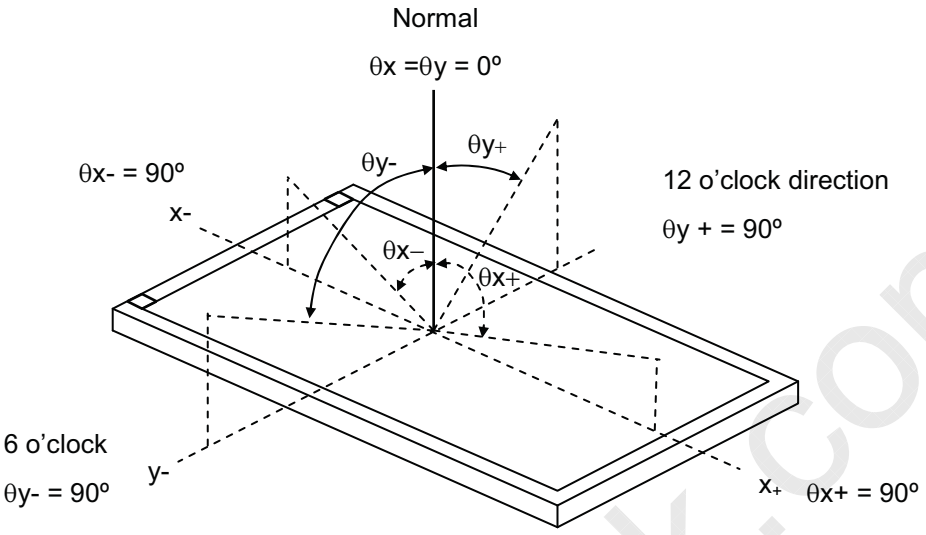
7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in 7.1.

Item		Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR			3000	5000	—	—	(2)
Response Time		Gray to gray			—	6.5	13	ms	(3)
Center Luminance of White		L_C	2D		320	400	—	cd/m²	(4)
			3D		—	60	—	cd/m²	(8)
White Variation		δW			—	—	1.3	—	(6)
Cross Talk		CT	2D		—	—	4	%	(5)
			3D-W		—	4	—	%	(8)
			3D-D		—	11	—	%	(8)
Color Chromaticity	Red	Rx		θ_x=0°, θ_Y =0° Viewing angle at normal direction	Typ.-0.03	0.636	Typ.+0.03	—	—
		Ry				0.339		—	
	Green	Gx				0.298		—	
		Gy				0.607		—	
	Blue	Bx				0.149		—	
		By				0.063		—	
	White	Wx				0.280		—	
		Wy				0.290		—	
	Correlated color temperature					10000		K	
	Color Gamut	C.G.			—	70	—	%	NTSC
Viewing Angle	Horizontal	θ_x+		CR≥20	80	88	—	Deg.	(1)
		θ_x-			80	88	—		
	Vertical	θ_Y+			80	88	—		
		θ_Y-			80	88	—		
Transmission direction of the up polarizer		Φ_{up}		—	—	90	—	Deg.	(7)

Note (1) Definition of Viewing Angle (θx, θy) :

Viewing angles are measured by Autronic Conoscope Cono-80



Note (2) Definition of Contrast Ratio (CR) :

The contrast ratio can be calculated by the following expression.

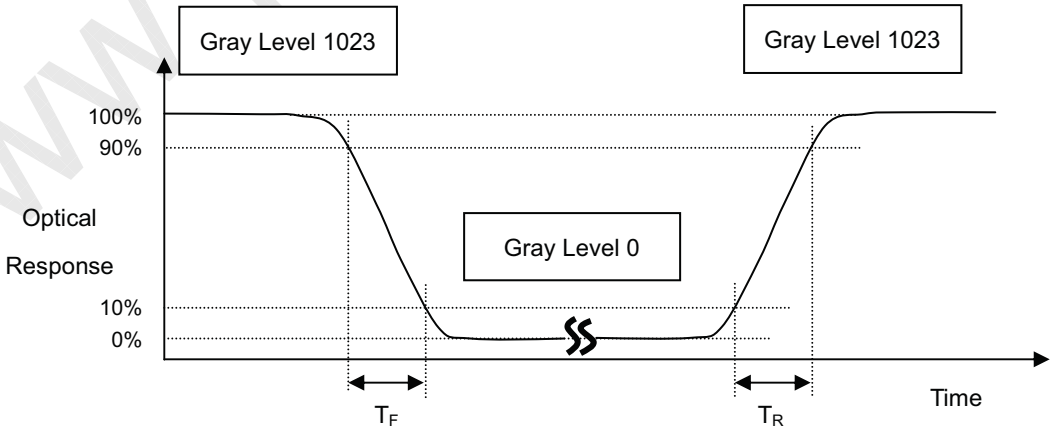
$$\text{Contrast Ratio (CR)} = \frac{\text{Surface Luminance of L1023}}{\text{Surface Luminance of L0}}$$

L1023: Luminance of gray level 1023

L 0: Luminance of gray level 0

CR = CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (6).

Note (3) Definition of Response Time (TR, TF):



The driving signal means the signal of gray level 0, 124, 252, 380, 508, 636, 764, 892 and 1023

Gray to gray average time means the average switching time of gray level 0, 124, 252, 380, 508, 636, 764, 892 and 1023 to each other.

Note (4) Definition of Luminance of White (L_C):

Measure the luminance of gray level 1023 at center point and 5 points

L_C = L (5), where L (X) is corresponding to the luminance of the point X at the figure in Note (6).

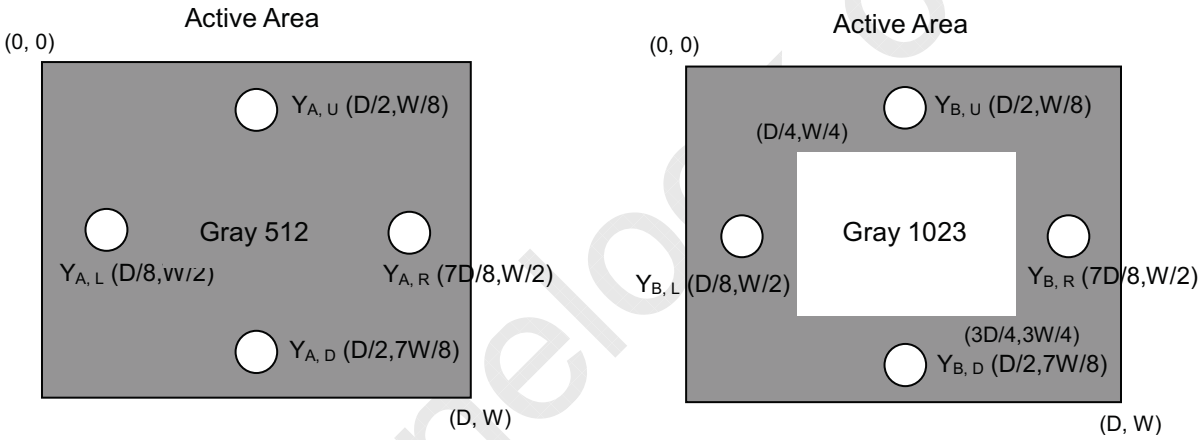
Note (5) Definition of Cross Talk (CT):

$CT = | Y_B - Y_A | / Y_A \times 100$ (%)

Where:

YA = Luminance of measured location without gray level 1023 pattern (cd/m2)

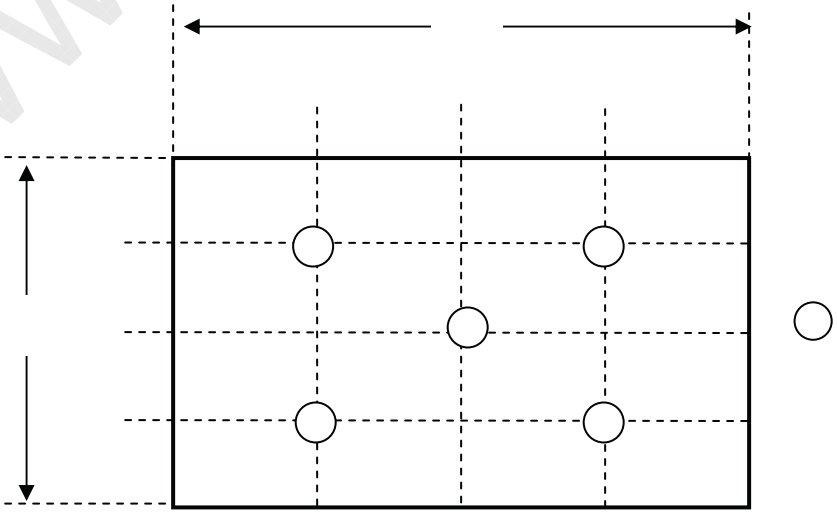
YB = Luminance of measured location with gray level 1023 pattern (cd/m2)



Note (6) Definition of White Variation (δW):

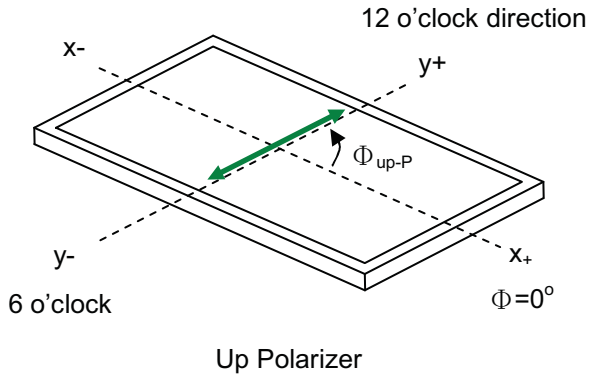
Measure the luminance of gray level 1023 at 5 points

δW = Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]



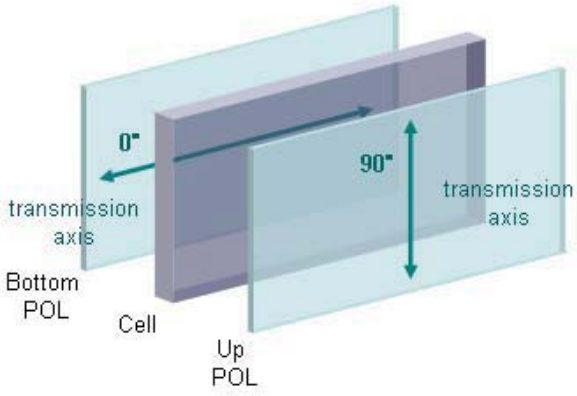
Note (7) This is a reference for designing the shutter glasses of 3D application.

Definition of the transmission direction of the up polarizer(Φ_{up-P}) on LCD Module:

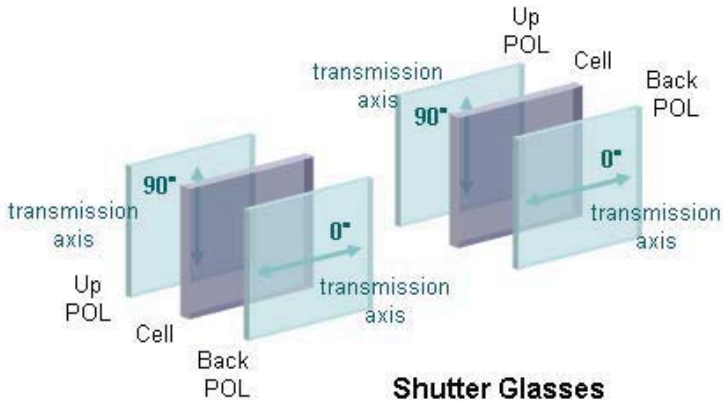


Up Polarizer

The transmission axis of the front polarizer of the shutter glasses should be parallel to this panel transmission direction to get a maximum 3D mode luminance.



LCD Module

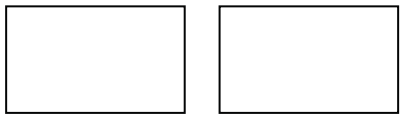


Shutter Glasses

Note (8) Definition of the 3D mode performance (measured under 3D mode, use CMI's shutter glass):

a. Test pattern

Left eye image and right eye image are displayed alternated



WW

Left eye image: W1023; Right eye image: W1023

WB

Left eye image: W1023; Right eye image: W0

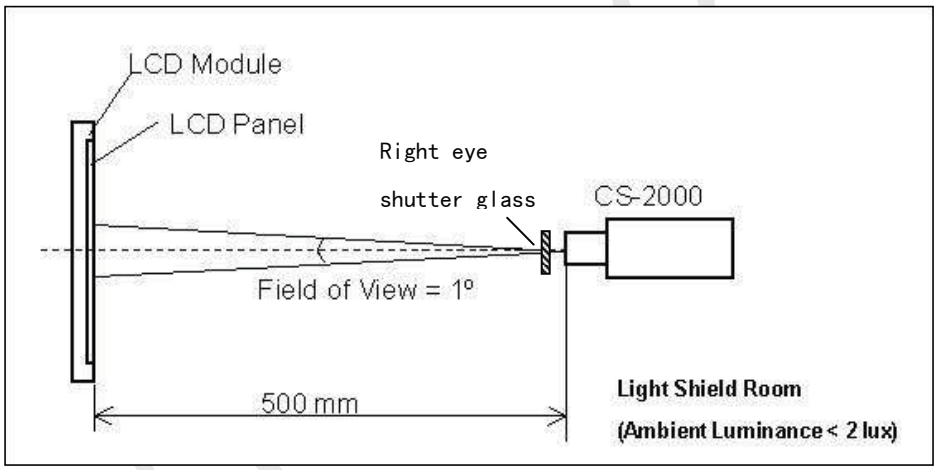
BW

Left eye image: W0; Right eye image: W1023

BB

Left eye image: W0; Right eye image: W0

b. Measurement setup



Shutter glasses are well controlled under suitable timing, and measure the luminance of the center point of the panel through the right eye glass. The transmittance of the glass should be larger than 40.0% under 3D mode operation.

The luminance of the test pattern "WW", denoted L(WW); the luminance of the test pattern "WB", denoted L(WB); the luminance of the test pattern "BW", denoted L(BW); the luminance of the test pattern "BB", denoted "L(BB)

c. Definition of the Center Luminance of White, Lc (3D) : L(WW)

d. Definition of the 3D mode white crosstalk, CT (3D-W) : $CT(3D-W) \equiv \left| \frac{L(WB)-L(BB)}{L(WW)-L(BB)} \right|$

Definition of the 3D mode dark crosstalk, CT (3D-D) : $CT(3D-D) \equiv \left| \frac{L(WW)-L(BW)}{L(WW)-L(BB)} \right|$

8. PRECAUTIONS

8.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) Do not apply rough force such as bending or twisting to the module during assembly.

(2) It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and backlight.

(4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.

(5) Do not plug in or pull out the I/F connector while the module is in operation.

(6) Do not disassemble the module.

(7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

(8) Moisture can easily penetrate into LCD module and may cause the damage during operation.

(9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.

(10) When ambient temperature is lower than 10ºC, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of LED will be higher than that of room temperature.

8.2 SAFETY PRECAUTIONS

(1) The startup voltage of a backlight is over 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the backlight unit.

(2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

(3) After the module's end of life, it is not harmful in case of normal operation and storage.

8.3 SAFETY STANDARDS

The LCD module should be certified with safety regulations as follows:

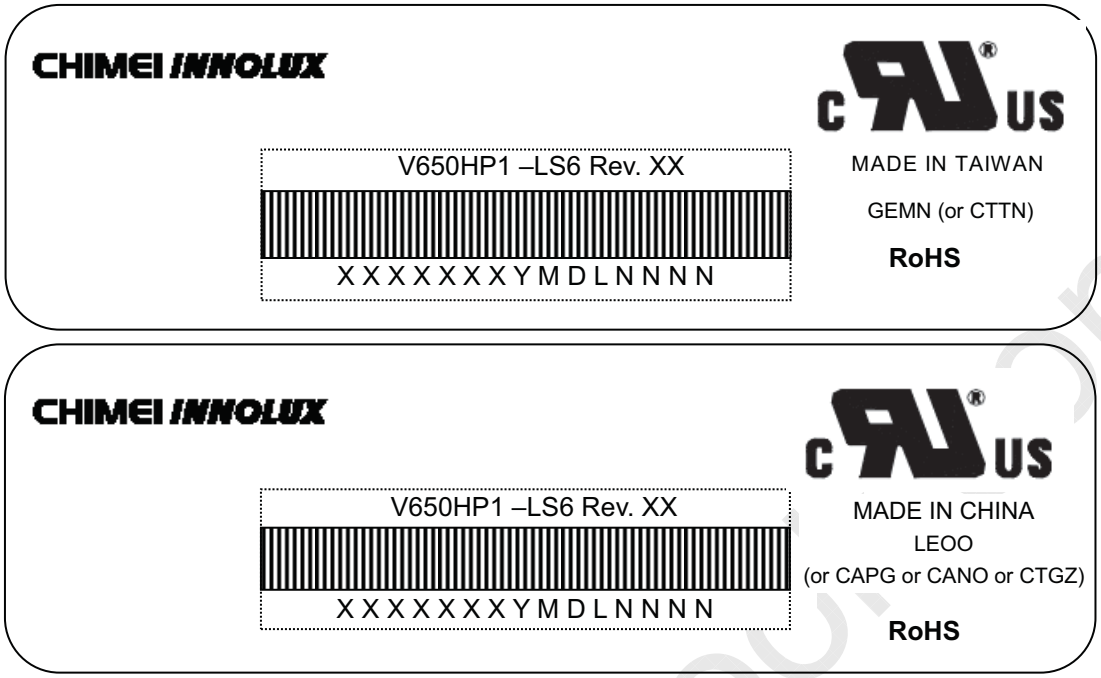
Regulatory	Item	Standard
Information Technology equipment	UL	UL60950-1:2006 or Ed.2:2007
	cUL	CAN/CSA C22.2 No.60950-1-03 or 60950-1-07
	CB	IEC60950-1:2005 / EN60950-1:2006+ A11:2009
Audio/Video Apparatus	UL	UL60065 Ed.7:2007
	cUL	CAN/CSA C22.2 No.60065-03:2006 + A1:2006
	CB	IEC60065:2001+ A1:2005 / EN60065:2002 + A1:2006+ A11:2008

If the module displays the same pattern for a long period of time, the phenomenon of image sticking may be occurred.

9. DEFINITION OF LABELS

9.1 CMI MODULE LABEL

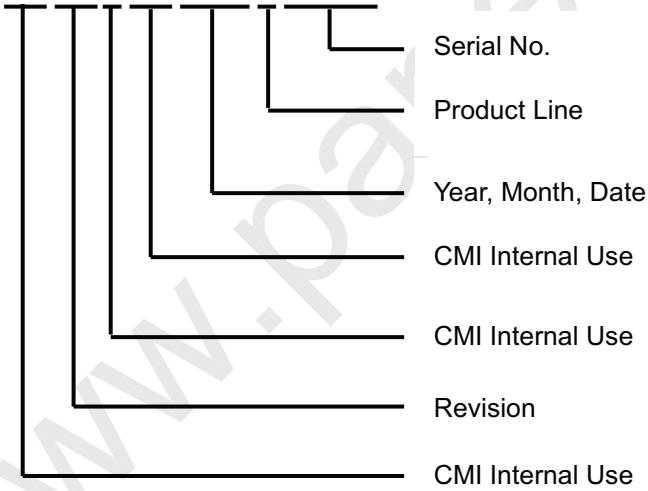
The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



Model Name: V650HP1 –LS6

Revision: Rev. XX, for example: A0, A1… B1, B2… or C1, C2…etc.

Serial ID: X X X X X X Y M D L N N N N



Serial ID includes the information as below:

Manufactured Date:

Year : 2001=1, 2002=2, 2003=3, 2004=4…2010=0, 2011=1, 2012=2…

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I ,O, and U.

Revision Code : Cover all the change

Serial No. : Manufacturing sequence of product

Product Line : 1 → Line1, 2 → Line 2, …etc.

10. PACKAGING

10.1 PACKAGING SPECIFICATIONS

(1) 2 LCD TV modules / 1 Box

(2) Box dimensions : 1645(L)x282(W)x982(H)mm

(3) Weight: approximately 60 Kg(2 modules per carton)

10.2 PACKAGING METHOD

Figures 10-1 and 10-2 are the packing method

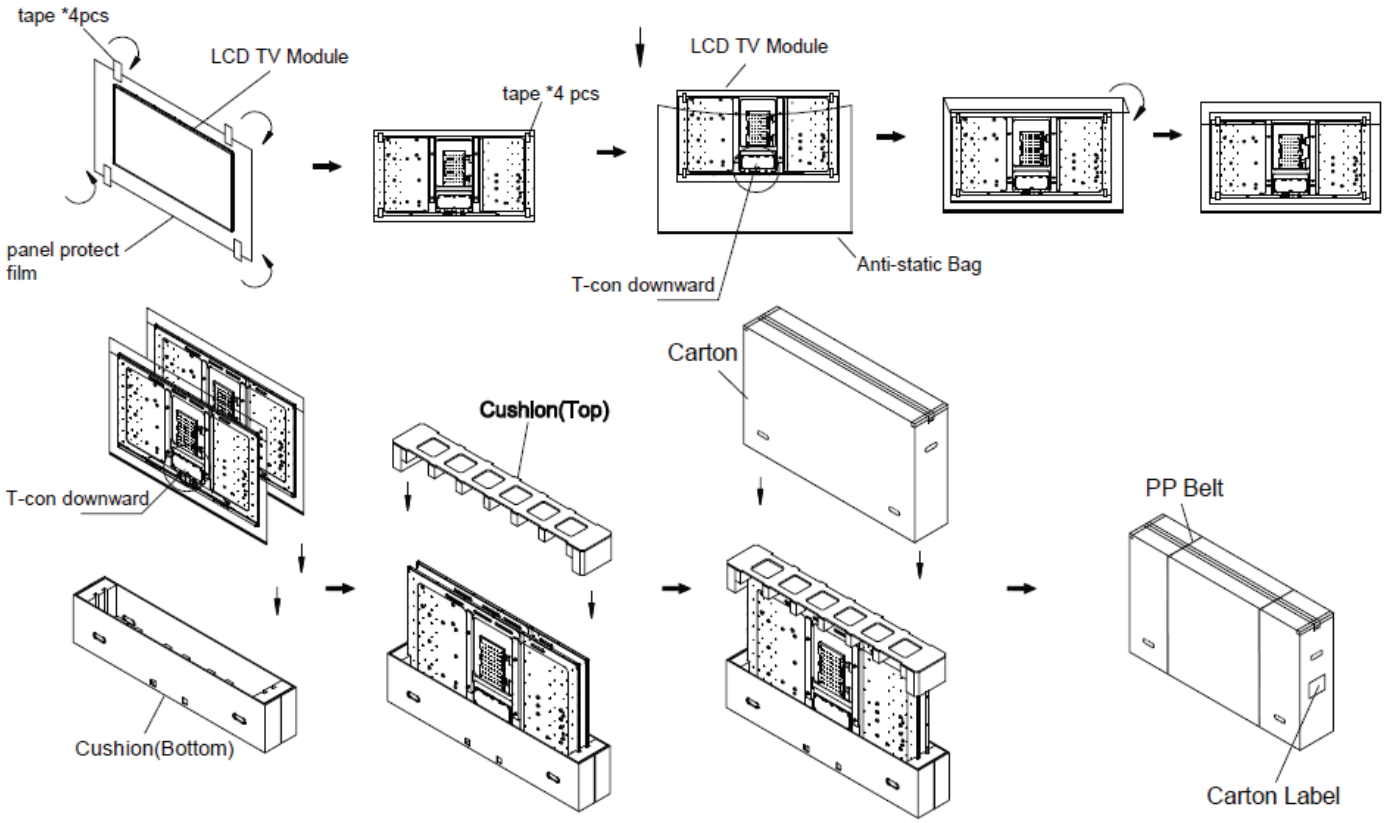
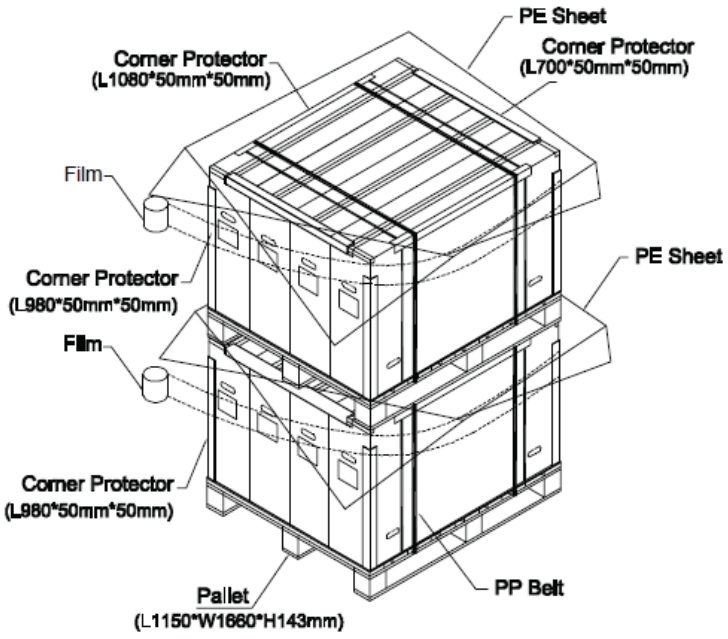


Figure 10-1 packing method

Sea / Land Transportation (40ft & 40ft HQ Container)



Air Transportation

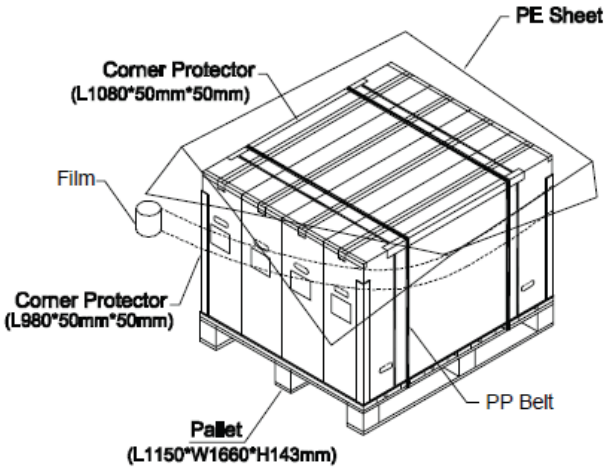
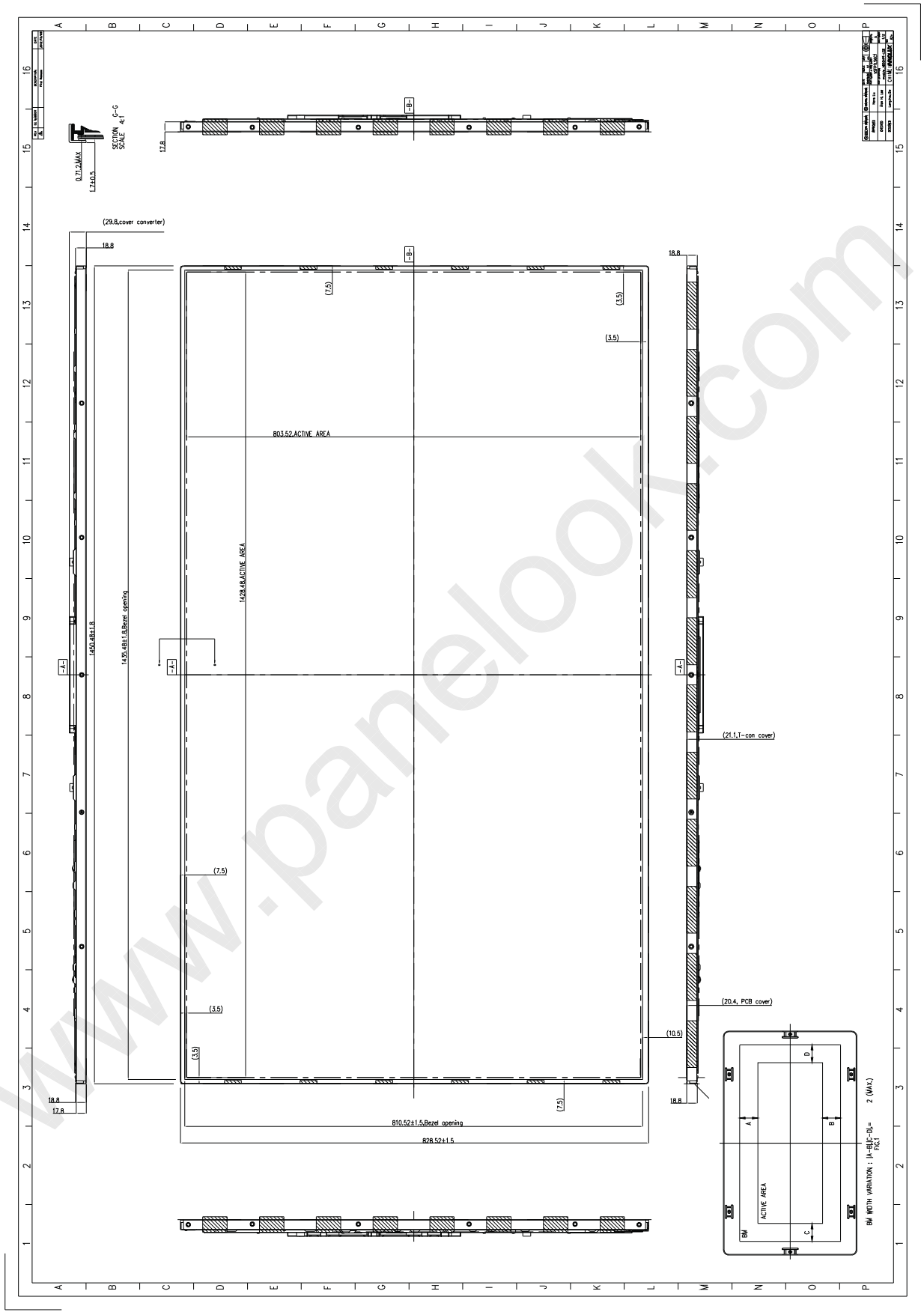
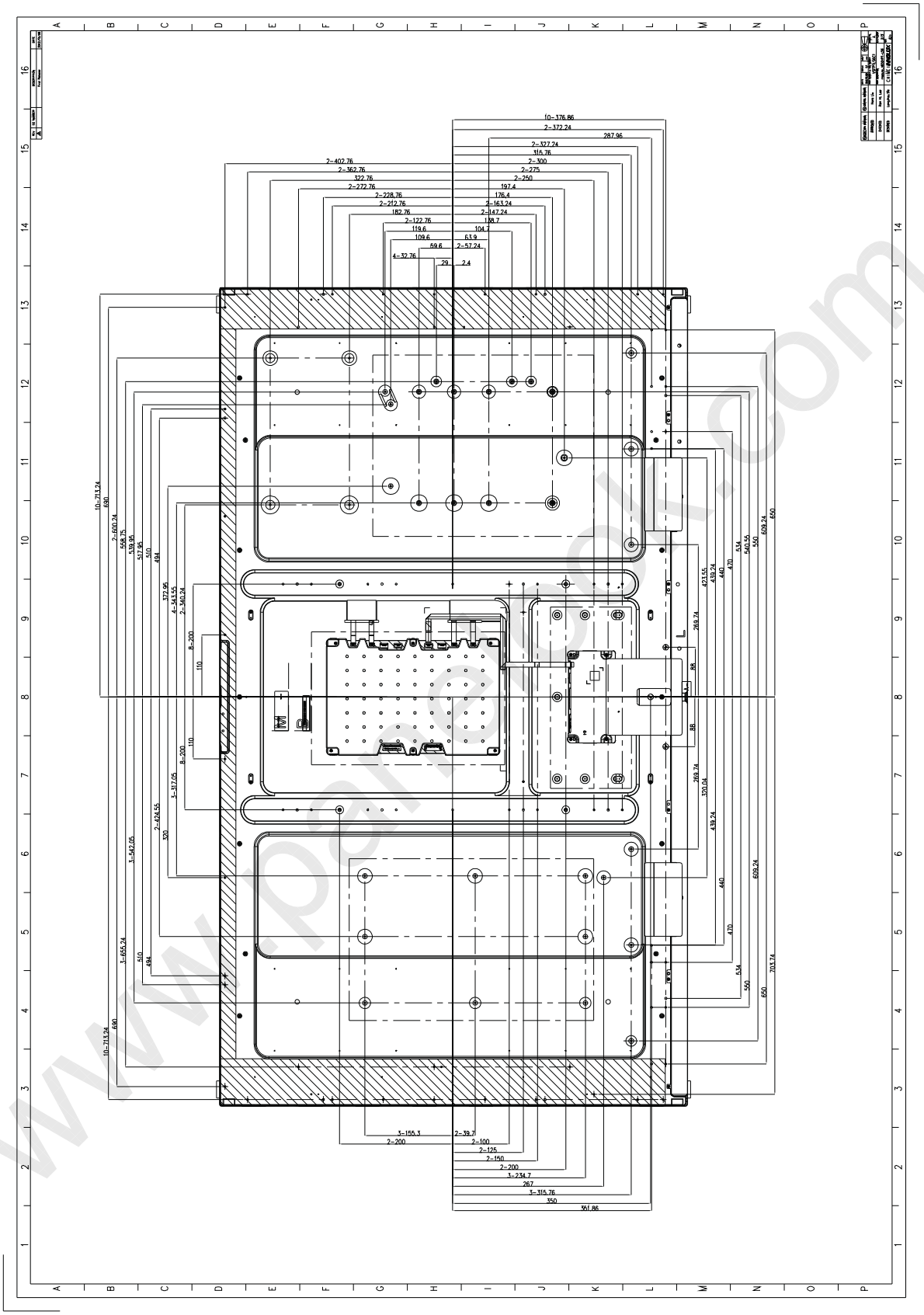
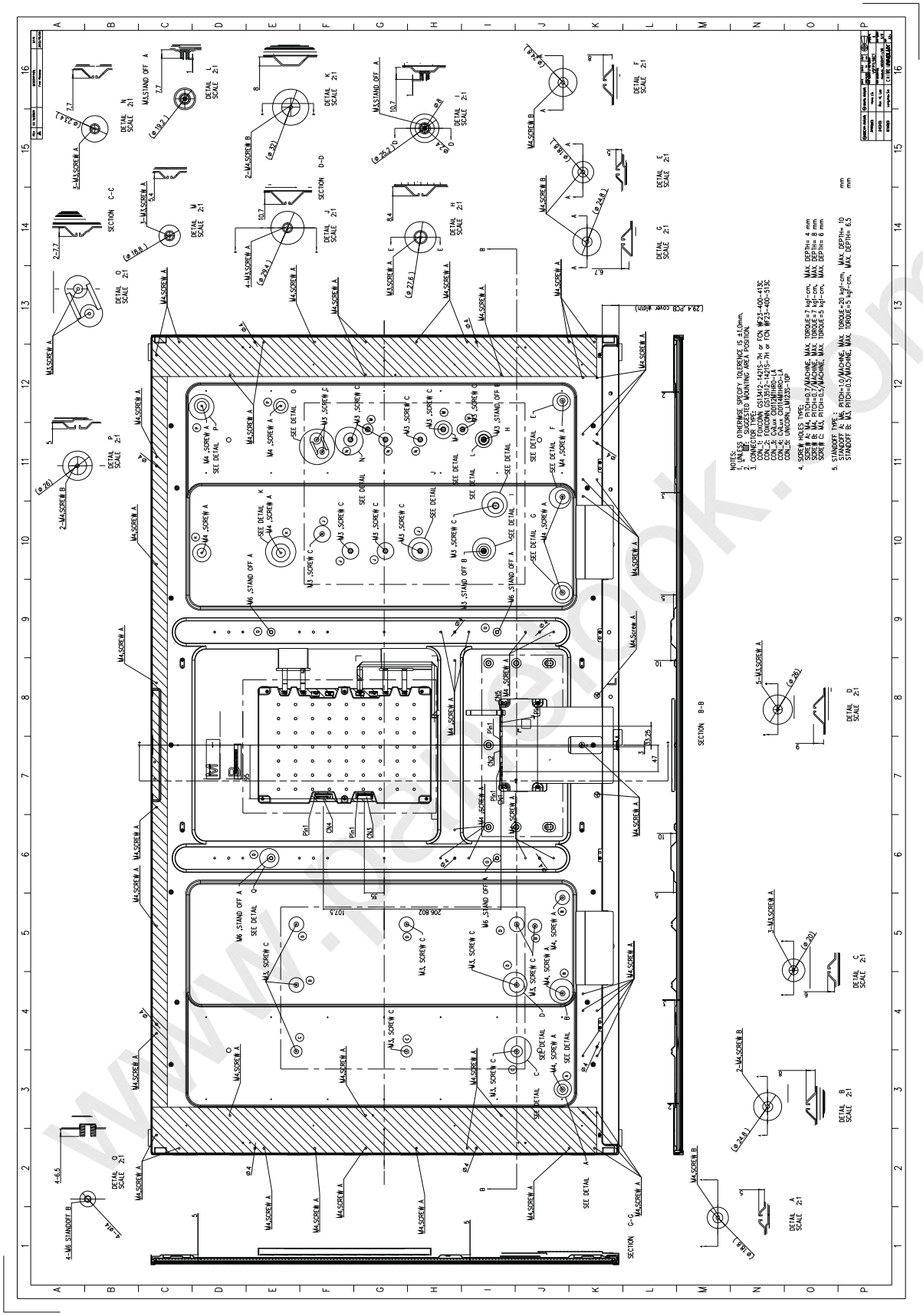


Figure 10-2 packing method

11. MECHANICAL CHARACTERISTIC







Appendix A

Local Dimming demo function

A.1 I2C address and write command

Device address: 0xC2

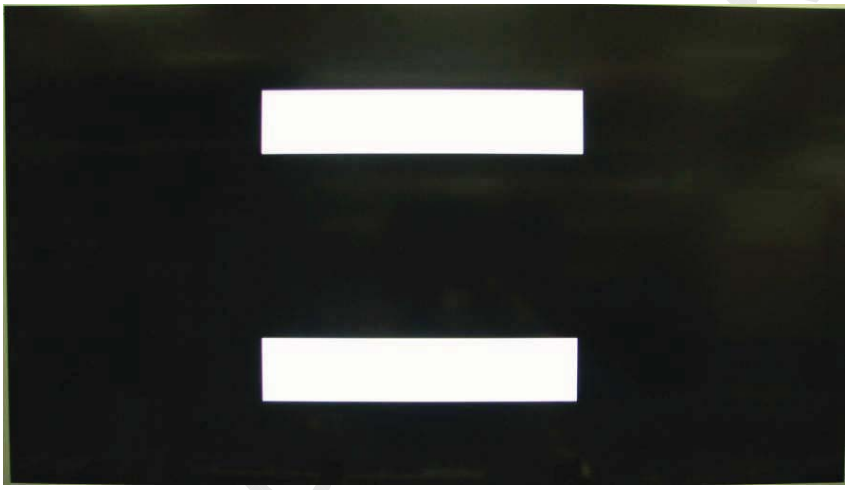
Register address: 0x01

Command data: 0x00: Local Dimming demo mode OFF (Note 1)

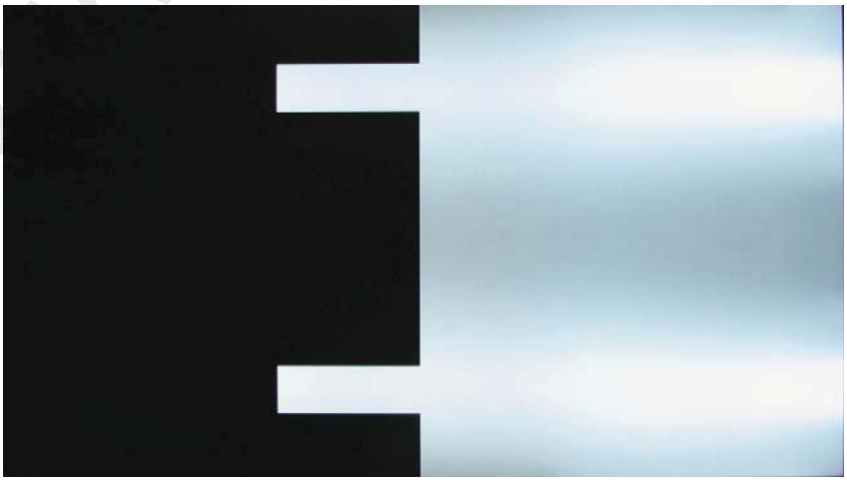
0x01: Local Dimming demo mode ON (Demo in right half screen) (Note 2)

	Device Address		Register Address		Command Data		
START	11000010 (0xC2)	ACK	00000001 (0x01)	ACK	00000001 (0x01)	ACK	STOP

Note 1: Local Dimming demo OFF



Note 2: Local Dimming demo ON



A.2 I2C timing

Symbol	Parameter	Min.	Max.	Unit
t_{SU-STA}	Start setup time	250	-	ns
t_{HD-STA}	Start hold time	250	-	ns
t_{SU-DAT}	Data setup time	80	-	ns
t_{HD-DAT}	Data hold time	0	-	ns
t_{SU-STO}	Stop setup time	250	-	ns
t_{BUF}	Time between Stop condition and next Start condition	500	-	ns